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MAY  
1959

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NUMBER 5

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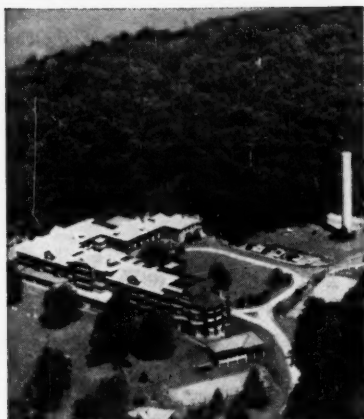
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## Review

### Light, Visible and Invisible

By *Eduard Ruedardt*. Ann Arbor, Michigan. 1958. University of Michigan Press. 201 pages. \$4.50.

Without light, comprehension of the manifold natural living things we enjoy would be impossible. Visible and invisible light makes photographs in the dark, heats our homes, weighs and measures stars, opens doors, cooks food, and even permits us to see through a solid block of steel. If a naturalist wants to know what a fish sees from below a pond's surface, why bees see white flowers as colored objects, why the beautiful color of iridescent butterflies, mother-of-pearl, and the brilliant plumage of the peacock is not due to pigment, and how to produce unorthodox and extraordinary photographs with the aid of invisible, infrared and ultraviolet light, this is the book for him. Copiously illustrated with 137 illustrations, this book, one of the Ann Arbor Science Library series and a translation from the German, is a fine introduction to a complex and important subject.

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4. "What-cheer, what-cheer, what-cheer."

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# Nature Magazine

MAY, 1959 VOL. 52 NO. 5

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## Reviews

### Nature Stories from the Vienna Woods

By Lilli Koenig. New York. 1959. Thomas Y. Crowell Company. Translated by Marjorie Latzke. Foreword by Konrad Lorenz. 159 pages. Illustrated. \$3.50.

There are human animals and there are animal people, says Lilli Koenig. The latter are those "who must have animals about them, who are always looking, listening, observing, who, with the curiosity and enthusiasm of children, study the lives of animals, in the attempt to fathom them." Mrs. Koenig is one of these "animal people," as this delightful book so emphatically proves.

In the Vienna woods, quite near to the city, yet in what is almost a primeval wilderness is a biological station created, against innumerable obstacles, by Otto and Lilli Koenig, staffed by equally enthusiastic young biologists and "peopled" by a wide and varied population of wild birds and mammals. The station started as a "squatter" in some abandoned huts of a wartime anti-aircraft installation, quite without permission, and is now accepted as an institution by the tolerant authorities. It is about the creatures that live here and whose habits of life are studied with sympathy and deep understanding, and yet with no urge to anthropomorphism, that this author writes. Whether she is telling of the problems of a graylag gosling, the doings of a dormouse, or the dilemmas of Dachsi, the badger, Mrs. Koenig writes with a special charm, indeed. This is, certainly, a Nature book that is as different as it is delightful.

R.W.W.

### Woody Plants in Winter

By Earl L. Core and Nelle P. Ammons. Pittsburgh 13, Pa. 1958. The Boxwood Press. 218 pages. Illustrated. Paper bound, \$2.75; cloth bound, \$4.00.

This is a manual and guide to identification of the woody plants of the northeastern part of the United States and southeastern Canada in winter. The authors, both professors on the faculty of West Virginia University, have tried out, on students during several winters, the identification criteria that provide their text here. With this book in hand there is no reason to feel that because a tree is resting for the winter you cannot get acquainted with it.

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# Nature IN PRINT

By HOWARD ZAHNISER

## Antidotes to Civilization

ARNOLD LUNN,  
WRITING A CENTENARY TRIBUTE  
to England's Alpine

pine Club, notes that most of the club's first recruits have come from city dwellers, and suggests that "perhaps the rapid development of mountaineering in the second half of the nineteenth century was in effect the response of man to a new need, the rediscovery of those spiritual values which were clouded by the smoke and grime of the industrial revolution." Calling this need "an antidote to civilization," he recognizes that "the country squire in close touch with nature did not feel the same need," thus emphasizing from the opposite viewpoint also the city dweller's "new need."

Arnold Lunn's volume *A Century of Mountaineering: 1857-1957*, a beautiful and interesting book, is primarily an account of the mountain climbers who made its history.

The book was conceived by the Swiss Foundation for Alpine Research as a centenary tribute to the Alpine Club. The Foundation then made a "search for an author," which ended, Othmar Gurtner tells us in the book's preface, when the decision was made on "a writer who could combine the factual approach of the historian with the personal interpretation of an essayist."

This description, the finished work clearly indicates, fits Arnold Lunn. His anecdotal and other circumstantial information about mountaineering personalities matches the scope of his understanding of the century's history of mountaineering—which he calls part of "the cultural history of our age."

He introduces his work by briefly tracing "the evolution of man's attitude to the mountains from the Greeks to modern times." He chooses as illustration not only striking photographs, reproduced in black and white, but also excellent full-page reproductions of eight paintings.

The result is indeed an interesting and beautiful book.

Martin Holdgate, writing of an expedition to an island in the South Atlantic, brings a reader some of the same sort of "antidote to civilization" that Arnold Lunn brings with accounts of mountain adventure. It may not be exactly the same motivation that prompted mountain climbers and the Gough Island expedition. The expedition's story is a travel tale of color and character of people in a far-away place, a description of sea and land, of seals and elephants, and birds of land and sea. It is not really a story of sport. But it is an account of adventure. The photographs of the faces of the three leaders and the six other members of the expedition are photographs of eagerness and self-reliance—an album of adventure. The very title of the book is an enticement away from urban thoughts, enticement well rewarded—*Mountains in the Sea: The Story of the Gough Island Expedition*.

### Few islands left

There are not many islands in the sea left for such explorations as Martin Holdgate records. There are not many mountaineering first ascents or climbs among virgin peaks that can lure climbers today or tomorrow. The antidotes to the ills of city and mechanized industry that one can take for oneself—not from another in book or picture—are possible for most of us and, in prospect, for even a larger proportion of our successors, only in the areas wild by man's choice and forbearance, areas which he may be able to preserve deliberately. Except to those who may be traveling into outer space the opportunities for such adventure as Arnold Lunn and Martin Holdgate describe apparently will be available for most of us from now on only in the areas of wilderness that we manage to set aside and protect with a firm and persistent purpose.

Such preservation of wilderness has seemed feasible as an enduring possibility, on an adequate scale, only by means of governmental programs—such as the one now proposed in

the United States by the Wilderness Bill pending in Congress. Lumbermen, grazers, and other commercial interests are opposing this measure, apparently not willing to see their future opportunities to exploit even the last remnants of wilderness curtailed. The legislation can succeed only if those who want some wilderness left are active and persistent in urging their Senators and Congressmen to support and advance it. Whether wilderness preservation with the governmental sanction and continuity that can make it endure will succeed is thus still a question. The likelihood, on the other hand, of any areas remaining unexploited through successive generations in private ownership seems so remote that it does not even seem to stir hopes among American conservationists.

### Travels in wild land

Both the importance of preserved areas in man's need for wildness and the rare possibilities for maintaining such areas in private ownership give added appeal, then, to another recent book about expeditions—Guy Mountfort's *Wild Paradise: The Story of the Coto Doñana Expeditions*. Published in England under the title *Portrait of a Wilderness*, the book's interest is not only in the indeed interesting people whose expeditions it records, but especially in the area of their wild-land travels. For this is an area in long-civilized Europe, in Spain, that is in private ownership—67,000 acres in a wild region on the southwest coast of Spain, not far north of Gibraltar. During the past 300 years, we are told, probably all the Kings of Spain have hunted deer and boars here. It remains in private ownership, but is still a great preserve. To share, even in reading, the experience of expeditions within it is a rare and exciting privilege.

The Atlantic coast and the *marismas*, the marshes of the Rio Guadalquivir, are effective geographic buffers for these wild acres on the west and east, and adjoining properties to the north and south are still largely maintained as hunting reserves. So the region "has lost little, if anything, of its unspoiled solitude." "The richest animal population of Europe roams free, and through its skies myriads of (sic) migratory birds pass each year."

The area, as our author points out in his preface, is "a reminder that

although much of Europe's natural heritage has been lost or destroyed, there are fortunately still a few, a very few, small areas of wilderness remaining where nature reigns unchallenged in all her splendour."

The author of *Wild Paradise*, Guy Mountfort, reconnoitered this remarkable area in 1952 with Roger Tory Peterson and then returned on larger expeditions in 1956 and 1957. Viscount Alanbrooke, author of the book's introduction, James Fisher, Eric Hosking, and Julian Huxley were among the members of the "team" that made the intensive studies of birds and the observations of other wildlife and the land itself of which the volume tells so well in text and photograph.

"No roads lead to the Coto. To reach its fastness one must still travel, as did the noble Dukes of Medina Sidonia on their hunting parties in the fifteenth century, by sailing up the broad Rio Guadalquivir from Bonanza and then riding on horseback for five or six hours, through the woods, across the desert and along the boggy edge of the great *marismas*."

In its wildness is the great appeal of the area—to visitor or to reader. Like mountains or island in the sea it offers a corrective to the developments of the urban, industrialized culture with which man, over so much of his earth, has separated himself from the natural surroundings he really needs and loves.

*A Century of Mountaineering: 1857-1957.* By Arnold Lunn. (A Centenary Tribute to the Alpine Club. Swiss Foundation for Alpine Research.) George Allen & Unwin Ltd., London. New York distributor: The Macmillan Co. 1957. (New York Publication, 1958). 263 pp. (6-7/8 by 9-7/8 in.), with preface by Othmar Gurtner, reproductions in color of 8 paintings (Wetterhorn by F. Hodler, Mont Blanc by A. Calame, Rosenlaui Glacier by J. Brett, Gepatsch Glacier by E. T. Compton, Weisshorn by A. Gos, Breithorn by F. Hodler, Piz Lunghin by G. Giacometti, and Monte Rosa by E. Aufdenblatten), 16 photographs by unidentified photographers on 16 plates comprising four 4-picture series entitled "A Circuit Flight round the Matterhorn," "The Beginnings of Mountain Photography," "Great Faces Introduce the Iron Age," and "Artificial Climbing Springs from the

Struggle Man versus Gravity," and index. \$6.75.

*Mountains in the Sea: The Story of the Gough Island Expedition.* By Martin Holdgate, with a foreword by H. R. H. Philip, Duke of Edinburgh, and a preface by J. B. Heaney. New York: St. Martins Press Inc. 1958. xvi + 222 pp. (5-5/8 by 8-3/4 in.), also with frontispiece and 6 other photographs in color on 3 plates, photographs of the 3 leaders and 6 other members of the expedition on 2 plates, 55 other photographs on 30 plates, tipped in folding map of Gough Island as mapped after the expedition, 3 test maps showing hemisphere position of Gough Island, the island before the expedition, and Tristan da Cunha, appendix on the place-names of Gough Island, and index. \$5.50.

*Wild Paradise: The Story of the Coto Doñana Expeditions.* By Guy Mountfort. Boston: Houghton Mifflin Co. 1958. 240 pp. (6-7/8 by 9-3/4 in.) with introduction by Field Marshall the Viscount Alanbrooke, 120 photographs on 60 plates. (3 photographs by Roger Peterson, 1 by E. R. Parrinder, 6 by the author, and 110 by Eric Hosking), 15 chapter-end line drawings by Penelope Mountfort and the author, drawing showing transect of the Coto Doñana, from the sea to *Marismas*, end-paper maps of the region, appendices listing the birds of the Coto Doñana region, the mammals of Andalucia, and the amphibians and reptiles of Andalucia, bibliography, and index. \$7.

#### Possums

*By Carl G. Hartman. Austin, Texas. 1952. University of Texas Press. 174 pages. Illustrated. \$6.00.*

This is a tardy review of what is without question the outstanding book on North America's only marsupial. Why the book did not come to us for review when first published we do not know, but recent correspondence with its distinguished author brought us a copy. Perhaps no mammal has been given such exhaustive consideration as has the opossum in this volume, for Dr. Hartman has studied the animal over a span of forty years. In it he has assembled fascinating history of misknowledge about the 'possum, of which there was a vast amount. The result is a book that, while providing the accurate facts, is most readable and entertaining.



...discover whether it is fact or fiction in this fascinating, incredibly documented book.

## ON THE TRACK OF UNKNOWN ANIMALS

by Bernard Heuvelmans

Introduction by Gerald Durrell  
Illus. with 54 photos, 120 drawings

If you have ever wondered whether the Loch Ness Monster was real, or what the Abominable Snowman might actually look like...or want to see the only "unknown" animal of which there is a good photograph, this amazing book will satisfy your craving, and much more. For, never before has such an impressive fund of scientific evidence, stories and pictures of real and fantastic animals been assembled in book form.

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Written with skill, scientific detachment, and without sensationalism, this definitive work is sure to provide you with many hours of fascinating reading and speculation. Gerald Durrell, one of England's foremost naturalists, says: "It will provide a spur, making you feel like leaving immediately on the trail of one of these strange creatures." 558 pp.

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## Reviews

### The Last Paradise

By Helmut Handrick. Translated from the German by Elizabeth Guild. Philadelphia 39, Pa. 1959. Book Division, Chilton Co. 160 pages. 58 large plates in full color. \$12.50.

The paradise of which this author writes is a small Nature refuge in the industrial Ruhr of Germany, a region not noted today for its beauty or natural history interest. The refuge is on an ancient private estate. There is old standing timber such is not often seen in this part of Germany. Kestrels and jackdaws nest in the walls of the old moated castle; lapwings and songbirds nest in pond and marsh. The refuge is rich in colorful insect life, flowers, funguses and small mammals. It is to this paradise that the author has repaired many times, and about which he has written of the seasonal changes and the inhabitants of the area. There, also, he has carried on his photographic activity and made the pictures that are so beautifully reproduced in large size. These striking plates give the first impression that this is primarily a book of superb pictures, superbly rendered. However, when one reads the text, and enjoys with the author his sincere joy in his paradise, it becomes a well-rounded volume of rare charm and beauty. R.W.W.

### The Good Year

By Era Zistel. New York. 1959. Thomas Y. Crowell Company. 199 pages. Illustrated. \$3.95.

It all began when the author was a schoolgirl with a habit of luring friendly dogs home from school, or acquiring cats of varying ancestry and degrees of wordly experience. The dogs already belonged to others and the cats were not popular with mother. Next came a fish, bought with a quarter, then another fish for company, and finally a growing number of tanks in which pollywogs grew into frogs, and fishes multiplied, until one large fish ate all the small fish and expired, apparently from indigestion. All this early concern with fauna laid the groundwork for the good year—the year that the author spent in a house in the woods with twelve cats, eight chipmunks, one rat, five goats, two raccoons and a dog, plus, of course, a tolerant husband. The result is a



Alice Mansueti

charming and entertaining little book through the medium of which the reader spends a good year with this interesting entourage. R.W.W.

**National Park Novels**

*Beckoning Landfall.* By Erick Berry. New York. 1959. The John Day Co. 192 pages. \$3.50.

*Hold Back the Hunter.* By Dale White. New York. 1959. The John Day Co. 189 pages. \$3.50.

There is, it seems to us, a novel idea in these two novels for the younger reader in the ten to fourteen age bracket. The novelty lies in the fact that both take a National Park for their setting, Mr. Berry's story being laid in Acadia National Park and Mr. White's in Yellowstone. For the Acadia story the author has chosen the period before the park was made a National Park and when lumbering still threatened. The Yellowstone story is laid against a background of an earlier day, the time of discovery of the myriad wonders of Yellowstone and the dedication of its discoverers to its protection. The publishers promise two more novels in this series, with Lassen Volcanic National Park and Everglades National Park as their settings.

## OUR MAY CONTRIBUTORS

Roger M. Latham, of Pittsburgh, Pennsylvania, ex-chief of the Division of Research of the Pennsylvania Game Commission, is presently the outdoor editor of the Pittsburgh Press. Mr. Latham was a graduate of the first class of the Pennsylvania Game Commission's training school for officers, and started his commission career as game protector, then wildlife research worker and biologist. He was a recipient of the Nash



Roger M. Latham

Conservation Award in 1954. . . Howard E. Evans is a resident of Ithaca, New York, and an associate professor at Cornell University, where he teaches and does research work in the department of entomology. Professor Evans, whose specialty is the systematics and behavior of solitary wasps, has published some 50 papers and a book, nearly all of which deal with this subject. . . Charlton Ogburn, Jr., full-time article and book writer and enthusiastic amateur naturalist, lives with his wife and two small daughters in Vienna, Virginia. Before taking up writing as a profession, Mr. Ogburn was an officer in the U. S. Department of State and a specialist in Asian affairs; during the second World War part of his five years' service was spent with the famed Merrill's Marauders in Burma. . . Andy Russell, one of our two Canadian contributors this month, has lived most of his life in the mountains of Alberta, and is a professional guide, lecturer, writer and nature photographer. Mr. Russell at present is nearing completion of a two-year color-photography study of the bighorn sheep that will eventually be available through a Canadian foundation for educational use. He is a resident of Waterton Lakes Park, Alberta. . . Our second Canadian contributor of the month is Gilean Douglas, nature photographer and writer who lives at Whaletown, on the beautiful coast of British Columbia. . . Mrs. Helen Hoover is a professional writer who, after her retirement as a research metallurgist, acquired, with her husband, a log cabin on Gunflint Lake in Minnesota, on the Canadian border forty-five miles from the nearest town. . . P. Belsky is an expert of the Reserves and Game Department of the U.S.S.R. Ministry of Agriculture. . . Before Alice Jane Mansueti's marriage to a fisheries biologist at the Chesapeake Biological Laboratories at Solomons, Maryland, she was a medical illustrator; she is now a scientific artist concentrating primarily on ichthyological drawings. Her husband is Romeo Mansueti, himself no stranger to Nature Magazine readers. . . Robert McCoy, former Chicago editor turned free-lancer, is an ardent national park and wilderness enthusiast.

### Briefly Noted

*Dictionary of Astronomy and Astro-nautics.* By Armand Spitz and Frank Gaynor. New York. 1959. Philosophical Library. 439 pages. \$6.00. Here are more than 2200 terms and concepts related to astronomy and astronautics concisely defined.

*Pigs, Tame and Wild.* By Olive L. Earle. New York. 1959. William Morrow and Company. Illustrated by the author. 64 pages. \$2.50. A junior book on this interesting animal family.

*The Independent Bluebird.* By Lucy Gallup. New York, 1959. William Morrow and Co. Illustrated by Louis Darling. 64 pages. \$2.50. Life from the bluebird nesting box to the birds a'wing.

*Stumpy.* By Emily E. Grant. New York. 1959. Greenwich Book Publishers. Illustrated by Norman Pomerantz. \$2.00. A story for children about a mouse.

*Everything Is Somewhere.* By Vasilin. New York. 1959. John Day Company. Illustrated by the author. \$2.75. Things in a child's life fall into place and perspective. To be read to the youngster. Charming illustration.



# Contents

## noted BY THE EDITOR

**ESTABLISHED IN MEMORY OF ALDO LEOPOLD**, the Leopold Medal is awarded annually by the Wildlife Society, professional organization of wildlife managers, technicians and administrators, for outstanding service in wildlife conservation. This is a coveted award, in no small measure because it seems to speak for the man for whom it was named, and whose conservation vision was outstanding and whose quiet leadership inspiring. Announcement of the award is made at the banquet of the annual North American Wildlife Conference, and this year the medal was given to Ernest F. Swift, executive director of the National Wildlife Federation. Mr. Swift is a conservationist who came up "through the ranks," learning his conservation first-hand in the wild, becoming a Wisconsin game warden and rising to be director of the Wisconsin Conservation Department and, later, assistant director of the U. S. Fish and Wildlife Service. This was the tenth award of the medal, those previously honored having been J. N. Darling, Carl D. Shoemaker, Olaus J. Murie, Ira N. Gabrielson, Harold Titus, Clarence Cottam, Hoyes Lloyd, C. R. Gutermuth and E. R. Kalmbach.

**STEADFAST CHAMPION OF THE MOURNING DOVE**, and opponent of its being considered anywhere as a game bird, is Guy Atherton of St. Paul, Minnesota. Some ten years ago he organized Conservation Militant, which was dedicated "to work for the increase and protection of valuable wildlife," but has primarily worked in behalf of the dove. We have corresponded with Guy Atherton over a considerable span of years, and have given him such help and encouragement as we could. Certainly he is regarded as a nuisance by gunners and unquestionably has frequently been described as a "crackpot," the favorite adjective of those who resent a viewpoint differing from their own. No doubt we are similarly regarded, because we have been unable to accept the mourning dove as fair game. It is a beneficial, pretty and none too bright bird the shooting of which can only be justified because it is a living target for the marksman. Its food value is insignificant. So we have sincere regard for Guy Atherton's dedication to his convictions, although we had not realized how deeply dedicated he really is. A recent letter stated that for five years he has been living "in voluntary poverty in order to pay printing and postage

bills for the growing needs of Conservation Militant." We salute anyone who will sacrifice until it hurts to further his convictions, right or wrong. In this case we believe Guy Atherton is on the side of right.

**CAPE COD NATIONAL SEASHORE** as a unit in the National Park System is a consummation devoutly to be desired. We urged such a move and described its possibilities in an article in our October, 1957, issue. Since that time a more detailed survey of the possibilities of preserving this seashore area has been made. The results of this are summarized in a booklet, published by the National Park Service, with privately donated funds, entitled "Cape Cod National Seashore: A Proposal." We have known the Cape intimately for a half-century and we have seen what "development" is doing to it today. Some of its manifestations are sickening. If this immediate report does anything—and we think this is an important proposal—it emphasizes the fact that time is running out. If what is yet salvageable of Cape Cod is to be kept from going the sad way of most of our eastern coast there must be prompt and public-spirited action to turn the proposal into a certainty.

**THE ZOOLOGICAL SOCIETY OF PHILADELPHIA** is this year a centenarian, and is observing this one-hundredth anniversary of its founding and the establishment of "America's First Zoo." Brought into being just before the Civil War, that conflict turned attention away for the time being, and it was not until March, 1872, that a reorganized program was launched; an engineer sent to Europe to study zoo architecture. Several buildings with a definite European flavor were erected in time for the Philadelphia Centennial Exposition of 1876, and some of the earlier buildings are still in use. An attractive folder has been published in observance of the centenary and illustrations showing the old and the new emphasize how far we have come in the handling and presentation of such exhibits. It is interesting to note that the zoological garden collection did not just grow from a small menagerie. It was a full-fledged institution with hundreds of specimens on the day the gates were opened. We salute the Zoological Society of Philadelphia, and the long years of educational service it has rendered in behalf of knowledge and appreciation of animal life.

R.W.W.



Looking north from the 10,778-foot summit of Mogollon Baldy, one of the highest mountains in southwestern New Mexico, the Gila Wilderness Area stretches away for miles into the distance.

*An Easterner looks at the*

## Gila Wilderness Area

**A**BOUT fifty miles north of Silver City, New Mexico, is a landmark known as Mogollon (pronounced "muggy-own") Baldy. Baldy is a mountain that rises nearly 11,000 feet into the thin atmosphere over southwest New Mexico, and it provides a panoramic view of the entire Gila Wilderness Area.

To an Easterner who has never visited western mountains, the view from this point is truly breathtaking. Great peaks of mixed vegetation and rock seem to stretch endlessly into the distance, broken only by the broad desert valleys of the Rio Grande to the east and the Colorado to the west. But even of greater significance to the naturalist than the grandeur of the

scenery is the realization that here is an area which, it is hoped, will remain inviolate. On these half-million acres natural conditions are being preserved so that future generations may see, as nearly as possible, what the country was like when first explored by the pioneers.

The Gila was the first wilderness area to be established in the United States, and came about largely through the efforts of Aldo Leopold, the great naturalist and wildlife conservation pioneer. Although set aside as early as 1924, it was not until June 8, 1933, that the area was officially designated by the Forest Service top command at Washington.

The Gila—from the Indian word meaning "spider"—

has much to offer the person wishing to see and enjoy Nature in all of its untouched beauty. For the naturalist there is an abundance of exciting animal life, an amazing mixture of vegetation, many kinds of minerals, and many unexplored cliff dwellings along the canyon walls.

The largest wild mammal present is the elk, which frequents the high parks and open forests. In the fall, the bulls can be heard at dusk bugling their challenge to other males in the vicinity. Far more common is the mule deer, with its over-sized ears and foolish curiosity, which stands its ground as the horseman approaches, and may permit him to ride to within a few yards before it bounds away in its peculiar fashion. All four feet strike the ground at once, and as the mammals disappear through the trees they remind the watcher of a bouncing rubber ball.

The beautiful bronze Merriam's wild turkey is a native of this region, and adds much to the charm of the wilderness. Other "game" birds are the dusky grouse, living at the highest altitudes, the Mearns' or fool quail, the introduced chukar partridge and the band-

By  
**ROGER M. LATHAM**

tailed pigeon. A large covey of Mearns' quail may flush right under your horse's feet in some grassy opening in the forest, and provide a considerable surprise to both you and your mount.

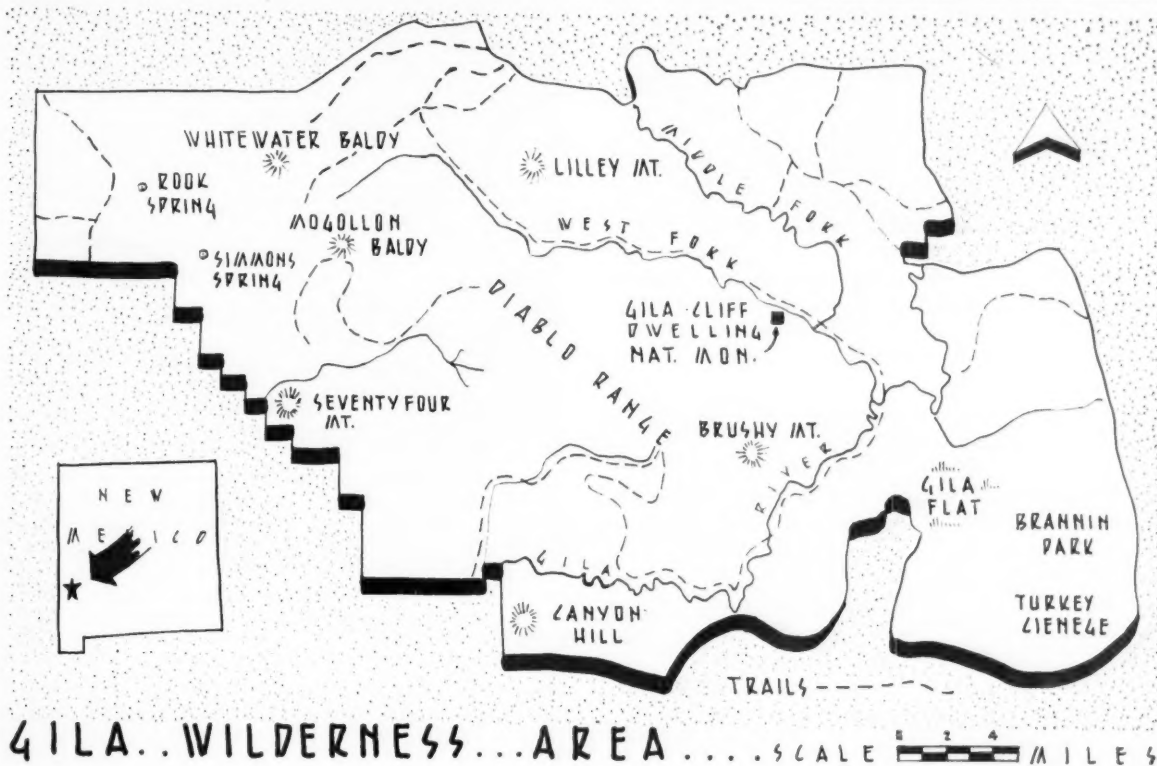
Although the grizzly bear has disappeared from the area, black bears are quite common. Mountain lions, bobcats, coyotes, foxes and porcupines are among the other larger mammals. There are numerous tree squirrels, ground squirrels, chipmunks, gophers and mice, all adding a bit of charm for the visitor. The Abert's, or tassel-eared squirrel, is especially striking because of the snow-white under surface of its tail.

A delightful experience for the amateur ornithologist is found in the considerable variety and number of hawks. Eagles, buteos, accipiters and falcons are all there, and are often in evidence. A few squeals on a predator-caller will bring one of these magnificent birds of prey from nowhere, and may cause it to light within a few feet of the caller's head, if he remains well hidden. The ravens with their guttural croaks and the jays with their odd mimicry are almost everywhere.

No less interesting are the reptiles of the area. The

The Gila Wilderness Area, first set aside in 1924, was established as a primitive area in 1933, and reclassified in 1953. It contains 562,609 acres in the Gila National Forest's Mogollon and Diablo Ranges. In the illustration below, a section of 125,000 acres lying to the right of the Gila Cliff Dwelling National Monument was not reclassified in 1953 but is still called "Gila Primitive Area," and is being managed as part of the Wilderness Area pending the results of a study by the U. S. Forest Service to determine its ultimate classification.

ILLUSTRATION COURTESY "THE LIVING WILDERNESS"





For people who like trees—big trees—and wild flowers, there are few places that can surpass the Gila Wilderness Area. Giant ponderosa pines and Douglas firs rise high above the trails, and the visitor is impressed with the park-like aspect of the forest with its ample ground cover of grasses.

only poisonous snake likely to be encountered is the western massasauga, called the pine rattler locally. There are many lizards, some scaled, some beaded, and mostly highly active. It is a pleasure to see these beautifully patterned little creatures running over the rocks or through the leaves.

For the person who likes trees—particularly big trees—and wild flowers, there are few places that can surpass the Gila Wilderness Area. Giant ponderosa pines and Douglas firs rise high above the trails, and form a backdrop of inspiring beauty and immensity for the traveler wherever he rides or walks. Hardly less attractive are the piñon pines at the lower levels and the Engelmann spruces on the very tips of the highest peaks. Adding to the picture are white firs, Mexican white pines, Rocky Mountain red cedars, alligator and Utah junipers, oaks, and aspens.

The visitor is impressed with the park-like appearance of the forests because the trees rarely have low-hanging limbs, and the ground is usually covered with a dense growth of grass. It seems, to the uninformed, as though someone had gone to great expense and pains to create this park-like condition.

On the steep, rocky canyon sides, shrubs become the predominant vegetation and even prickly pear and mesquite can be found. Mountain mahogany, scrub oak and manzanita are common shrubs. In the higher elevations the annual rainfall may be as much as thirty inches or more, and wildflowers are exceedingly abundant. In October, yellow, orange and blue seem to be the predominant colors. Lupine, asters, paintbrush, columbine, monkey flowers, phlox, groundsel, pingue and daisies add much to the beauty of the landscape.

At every turn there are new minerals, new rocks and new specimens for the collector or amateur prospector. The mountain streams contain gold dust that can be



Many streams tumble through the steep-walled canyons of the Gila Wilderness Area. This photograph was taken on the West Fork of the Gila River a short distance below the White Creek Ranger Station, in the heart of the Wilderness Area.

"panned" by anyone wishing to try his hand. Whole slopes may be covered with red, orange or lavender lava rock, and throughout the region semi-precious stones and various minerals may be found in the outcroppings.

For the fisherman or hunter the Gila Wilderness Area



The largest cave in the Gila Cliff Dwellings is nearly 50 feet in diameter, and permitted construction of several buildings by the people who occupied the cave more than 600 years ago. The cliff dwellings are preserved as a national monument on the edge of the Gila Wilderness area.



is indeed a wonderful place. Its mountain streams are the picture of what most fishermen envision as perfect trout water. The smaller streams are "loaded" with the pinkest, firmest and scrappiest rainbows to be found anywhere. Although in such small streams most of the rainbow trout measure less than twelve inches long, they are there by the hundreds and have been almost untouched by fishermen. Many streams are literally unfished for years at a time!

The larger streams have both rainbows and "native" browns. The Loch Leven trout, as it is called locally, is quite different from the Eastern brown trout. It is highly colored, and the adipose fin has three large, orange-red spots on it instead of being a solid dark red as in stream-hatched Eastern browns. It has a golden belly, large red spots, and red-tipped fins and tail—coloration that makes it almost the equal of any trout, including that universal favorite, the brook trout.

These fish strike with great abandon, and the fisherman can take his limit of twelve in no time. In most streams the fish are particularly heavy for their length, and a twenty-inch fish may weigh three pounds—and put every ounce of the three pounds into the fight for freedom. But, at the same time, the fish are wary and must be approached with great caution. All these fish are spawned in the wild, and are not stocked from a hatchery.

One of the delights of fishing the headwaters of the Gila River is the company that is so often with you. Every stream seems to have a goodly number of water ouzels, or dippers. These strange birds, about the size of a robin with its tail cut short, secure all of their food under water. They actually walk on the bottom, in swift riffles where the water may be a foot or more deep, in their search for aquatic insects under the pebbles and small stones. These birds can even fly under water, using



To fish the upper waters of the Gila River, a trip by horseback for at least twenty miles into the Gila Wilderness Area is necessary. This fisherman is after trout in the West Fork of the Gila, near the White Creek Ranger Station.

their wings to good advantage to move against the current! Even their nests are usually placed behind a waterfall so that they must walk or fly through a curtain of water to get to them. When one of these friendly little birds is performing in a pool before the fisherman, it would be a strange individual indeed who would not pause to watch the odd behavior.

In the fall, hunters pack in by horse and mule to hunt elk, deer, turkeys and grouse. Limited seasons and permits insure the perpetuation of all "game" animals. Because there are no roads, and all vehicular travel is prohibited, the interior of the area never is overcrowded. However, several packers serve the region, and the

hunter, fisherman or naturalist should find no difficulty in getting good guides and comfortable camps for a trip into the wilderness.

Certainly not the least of the attractions of the Gila Wilderness Area are the many cliff dwellings. A number of these have never been explored, and may be seen in many places high on the sides of the canyon walls. The most famous of the ancient dwellings—still relatively little-visited—are located at the Gila Cliff Dwellings National Monument. Here, on the floors of four large

caverns and their associated adobe dwellings, may still be found pottery, fragments, corn cobs, animal bones, arrowheads and other indications of an early Southwestern culture.

Yes, the Gila Wilderness Area is a place where those who love and appreciate Nature can go to see and study, away from the crowds. It is indeed a place where you can satisfy your urge for solitude; and certainly, to the Easterner, it is a privilege to be able to spend a time—even a short time—in such an unspoiled wilderness. ♡

## The Tide Comes In

By HAYDN S. PEARSON

NO MAN can tell the exact time when the tide of a new season begins. Astronomers inform us of the exact hour and second of the vernal equinox in March, and human hearts rejoice in the promise of resurrection. April, however, is often recalcitrant and sullen; there are usually many days of raw winds and pelting showers. True spring frequently comes early in May, and then one can watch the tide of deepening green flow over fields and valleys, hillsides and pastures.

There are waves of color following each other in regular order each year as certain species of flowers open their petals, receive life-giving pollen and mature their seeds. Day by day through the fifth month, the swelling tide grows in power and momentum. When May is done and June's beauty and warmth blesses Earth, the high tide of Year approaches. Green lines grow taller on cultivated fields and hayland grasses rush toward maturity. The birds' chorus reaches crescendo in the early days of

the month. One can feel the primal, irresistible urgency of Nature as the day of the Great Pageant gradually approaches.

Probably more flowers are open on Year's longest day than during any other twenty-four hour period of the yearly cycle. A man should go out on the flower-dotted meadows and on the hillsides. Look closely among green grasses and you will see beautiful pastel blossoms of many humble plants of Earth. Fields and meadows have been building toward this climax day since the sun began climbing back to the zenith. Not yet faded and dusty foliage; now the full flush of green glory and beautiful colors. The tide rolls in and the heart is grateful for the beauty. Each month of year, and each of the major seasons, has its special glory and appeal. But when the tide comes in as Summer approaches, he who will can find a glory and beauty that has never been caught on canvas. ♡ ♡ ♡

## THE GROSBEAK'S VESPER SONG

*The song that fell from the greenwood tree  
And bathed the evening air,  
Was the sweetest musical melody  
That ever gladdened my ear.  
'Twas an old friend singing his vespers  
Before the night came on,  
To his little mate who nestled his babes,  
This quiet sundown song.  
Not like the morning flutist  
Who wakens up the dawn,  
But a lullaby, to his children nigh,  
And the day that was almost gone.  
So sweet were his gentle whispers,  
They cast a mystic spell  
Upon the darkening twilight,  
And the listener, as well.  
Should you ever hear this grosbeak,  
The black-headed's vesper song,  
Your heart will sing long after  
The song and the singer are gone.*

Ebon B. McGregor

# *Isodontia*, the Grass-Carrying Wasp

By HOWARD E. EVANS



A close view of the wasp's nest in a split sumac twig shows the details of cell construction. Apparently the eggs in these cells failed to hatch, and the dried bodies of tree crickets fill the cells.

NEARLY everyone is familiar with the delicate grass nest of the chipping sparrow and the rude mud cup of the robin. Some even have had the fortune to find the nest of the goldfinch, with its lining of thistledown, or the tiny lichen bowl of the hummingbird. Others have watched the woodpecker hew its nest from wood, the kingfisher tunnel in a clay bank along its favorite stream, or the cliff swallow plaster its mud sphere to a rocky ledge. Justly famous are the birds for the infinite variety of their nests.

Yet the wasps and bees use all these methods of nest construction and a number of others as well. Clay banks are frequently riddled with the tunnels of various bees and wasps. Carpenter bees carve long, tubular nests in dead trees and wooden buildings. The mud-daubers fasten their adobe cells to hollow trees, bridges, and the roofs and walls of open buildings; the potter wasps practice their skilled ceramics on the twigs of trees. Hornets and yellow-jackets have mastered the art of making paper from wood pulp and using it to build elaborate apartment houses. The bumblebee produces wax that it uses for building vats in which to store honey to feed the young. The leaf-cutter bee encloses its nest-cells with bits of leaves and sometimes even with rose petals, while certain other bees glue small pebbles together to make a nest along the stem of a plant. But, alone among the bees



The grass-carrying wasp, *Isodontia*, visits one of its favorite sources of nectar, the sweet white clover.

and wasps, the grass-carrier uses grass as its principal building material.

Grass, of course, is the commonest ingredient of most birds' nests, and one often sees a bird flying to its nest with a straw in its bill. It is a far more remarkable sight to see *Isodontia*, the grass-carrying wasp, flying through the air with a straw several times the length of its body! For a number of years I have seen these wasps flying high into crevices in my house, perhaps into holes made by carpenter bees. I have never studied these nests, as that would require taking the house apart, but on other occasions I have found their nests in the hollow twigs of dead sumacs. Others have found them in quite a variety of natural cavities, their nests always stuffed with grasses and other plant materials. Actually, *Isodontia* belongs to the family of digger wasps, so called because most of them dig a nest in the soil. Related to the grass-carrier is the great golden digger, a large and beautiful red, black, and gold wasp that hunts katydids and places them in a nest deep in a gravel bank. Through some quirk of evolution, *Isodontia* has abandoned this method for a far more refined—if equally laborious—procedure.

It was A. S. Packard, in 1869, who first reported on the nesting behavior of *Isodontia*. Packard, as a youth, used to go to bed evenings with the windows open and the lights burning, so that he could observe the many insects that flew to the light. Later he became a professor of zoology at Brown University, and one of the pioneer entomologists in the country. In his classic *Guide to the Study of Insects*, he reported the rearing of *Isodontia* from cocoons found in abandoned tunnels of a carpenter bee. The cocoons were separated by bits of

rope, and the end of the nest was filled with a tight wad of sedges. Since that time a number of observers have noted the unusual nesting habits of these wasps. There are numerous species in different parts of the world, and all of them are rather similar in their behavior. But to this day the only person to have studied a grass-carrier in detail is Octave Piel, a Jesuit priest who lived in China. Father Piel was able to induce the wasps to nest in hollow bamboo stems in great numbers, and by patient observation he was able to learn much of their lives.

The grass-carriers are by no means spectacular in appearance. They are medium-sized, about an inch long, with a slender body and long wings. Our common species are black, but some of the tropical species are variously marked with red or yellow. Often they are seen on flowers, for both sexes feed on nectar; they are especially partial to sweet clover. The male does little but court the female and rest in the sun. But the female is quite another story; she is an energetic creature, a gatherer of grass blades and a hunter of tree crickets and meadow grasshoppers.

*Isodontia* is strictly an opportunist when it comes to selecting a nesting site. Almost anything will do as long as it is hollow and about a half-inch in diameter. Abandoned carpenter-bee nests or other unused cavities in wood are favorite places. The nest in the photograph on the first page of this article was found in the hollow stem of a dead sumac; there were remnants of mud plugs in the cavity, indicating that the same stem had been used the preceding season by a mud-carrying wasp. Grass-carriers also will nest in the abandoned burrows of mining bees in clay banks. In the Southwest the wasps make use of the leaves of yucca or Spanish dagger, which, when they grow old, roll up so that they form long tubes up to two feet in length. In the Southeast

Having measured and severed a blade of dry grass, *Isodontia* flies off toward her nest with the grass blade trailing behind her.



the wasps exploit the most unusual natural cavities of all—the long, tubular leaves of the yellow-flowered pitcher plant, or huntsman's horn. As in all pitcher plants, these leaves are specialized for capturing insects, and have even been known to capture bumblebees. *Isodontia* merely stuffs the watery bottom of the pitcher with grass or sphagnum moss and proceeds to nest



*Isodontia* is ready to sever a strand of grass to plug the entrance to her nest.

Illustrations by Enrico Sismondo

quite successfully in the upper part of the leaves.

Once the nesting site has been selected the work really begins. It is not just a matter of gathering blades of grass indiscriminately and stuffing them helter-skelter into the hole. For the partitions between the brood cells special types of fibers are selected. These may be very fine grasses, strips of epidermis from herbs, various types of woolly plant down, or even—in the case of Packard's wasp—bits of rope. This material is chewed up and pressed into a compact plug. Then, when the cavity has been nearly filled with a series of cells, each separated by a partition of this kind, the wasp begins to gather somewhat coarser strands, which are twisted in such

a way as to fill the cavity rather loosely. For this part of the nest the wasps have even been known to use excelsior! Finally, when only an inch or two remain to be filled, long, stiff grasses are collected and stuffed into the entrance-way. Eventually these grasses form a broom-like tuft that projects from the hole. It is strange, indeed, to see such a broom of straws projecting from a hole in a clay bank or hollow twig! The function of this broom is quite unknown; it is almost as though the wasp were carried away by its own cleverness and artistry. The broom weathers away fairly soon, and one can usually guess how old a nest is by the condition of the straws at the entrance.

When the female *Isodontia* is after straws for the broom, she flies to tufts of tall grass and examines the dried blades of last year's growth. She flies from plant to plant, apparently appraising individual straws for thickness and rigidity. When she finds one that is suitable she walks out to the tip and then back again a certain distance, apparently measuring off the required length. Then she neatly cuts it off between herself and the base of the straw, like the man who saws off the limb on which he is sitting. But in this case the wasp buzzes her wings as she severs the straw, and in a split second she is flying toward her nest with the straw trailing behind.

All of this labor is, of course, part of the wasp's way of providing for the survival of her offspring. In each cell of the nest she has placed an egg and the necessary food for the development of the larva that hatches from it. This food, too, is of a special sort. *Isodontia* is a hunter of tree crickets and meadow grasshoppers. Each cricket or grasshopper is stung, usually about three times, on the under side near the nerve cord. Then the wasp grasps the grasshopper in her jaws by the antennae and flies back to the nest. She lays her egg on the first hopper in the cell, then packs in several more before



closing it up. The grasshoppers remain immobile but fresh and alive for a week or more, while they are being eaten by the young wasp larva. In any one locality, *Isodontia* seems to concentrate on one kind of prey. Most commonly used are tree crickets, *Oecanthus*, delicate green insects that produce shrill, piercing tones from trees and bushes in late summer. Despite their attractive appearance and their musical propensities, tree crickets are justly regarded as pests by the farmer, for they injure the twigs of bramble and tree fruits by their egg-laying punctures. One can imagine that a number of grass-carriers in a neighborhood might considerably reduce the population of tree crickets. The nest in the photograph, undoubtedly built by a single wasp, contained six cells. In those four cells in which the crickets



The wasp places a straw in her nest (redrawn after Octave Piel). Eventually the grasses will form a broom-like tuft that projects from the hole. The function of this "broom" is still a matter for conjecture.

had not been consumed (apparently because the egg of the wasp failed to hatch) there were about six crickets per cell. Thus, one wasp apparently destroyed about thirty-six tree crickets in the process of provisioning one nest.

Although this particular nest contained nothing but tree crickets, nests have been found that contained variable numbers of green meadow grasshoppers along

with the crickets. The nests in yucca leaves mentioned earlier, which were studied by a noted collector and student of insects, George P. Engelhardt, were found to be supplied exclusively with immature Texas spiny katydids. These katydids live among spiny plants like cactuses and are rarely collected by man. The adults are three or four inches long and are capable of inflicting a painful bite if handled. Mr. Engelhardt examined forty or fifty brood cells and found that each one contained three or four young spiny katydids. Since there were hundreds of wasps flying around the yuccas, they must have captured in all several thousand katydids.

When the wasp larva is full grown, it spins silk from its mouth parts and weaves an elongate cocoon in which it rests. Adult wasps emerged from these, indoors, in April. The total length of the nest shown on the first page of this article was 9½ inches. Each of the six cells was about one inch long, the grass plugs between them about one quarter of an inch long, and at each end of the nest was a grass plug about an inch in length. The "broom" at the entrance had weathered away.

So *Isodontia*, that ordinary-looking wasp, is really not so ordinary. She is an artist of sorts, and a connoisseur of the finest of preserved insects—the musically inclined crickets and katydids. She knows her way around in her world—knows when and where to gather specific types of fibers, how to manipulate them, and what to do with them; knows where to find the right kind of grasshoppers and how to preserve them for her offspring; knows how to finish off her nest with a strange broom of straws. She knows these things not because anyone has taught her—for long before she emerged from her cocoon her parents had disappeared—but simply because she is *Isodontia*, the grass-carrier. She could just as well build a mud nest and stock it with spiders, like a mud-dauber. But she does not, any more than a kingfisher would build a nest of thistle-down and live on seeds.



## THE LIVING WALLS

*Tonight I lie again beneath the roof  
Of my grandfather's house and hear the smali,  
Sly scurryings of mice about their old,  
Mysterious connivings in the wall.  
So busily they work the night away  
That to my drowsy listening it seems  
Their verve has charged this house until it snaps  
And crackles from its ridgepole to its beams.  
My own new home will never know a mouse.  
Its insulated walls would be a poor,  
Cold host to those who like the dusty warmth  
Of space and dark behind the chimney's roar.  
My glass and tile are mouse proof, smooth, unmarred,  
Successful in their sleek design for giving  
Grace to life—but I miss older walls  
Whose hundred hearts speak audibly of living.*

Catherine Cameron Thaxter



Spruces darken the mountain-tops of the southern Appalachians and march to the brink of the sea on the coast of Maine.

WHEN I was thirteen years old and spending the summer working on a farm in southern New York, I put in a strenuous hour one evening helping transplant a small hemlock tree. The moving spirit behind this project was not my employer but a co-worker, an English boy newly arrived in the United States. Sinclair Wilcox-Jones was only two years older than I, a country boy with no education beyond grammar school. Yet at fifteen he had an impelling picture in his mind of what a young hemlock planted at the bottom of the garden would become by the time he had reached middle age. So when the day's work was finished we walked a mile and a half to the woods, dug up a two-foot tree, loaded it with a heavy ball of earth in a burlap sack, and struggled back to the garden with it.

What has happened to Sinclair I do not know, but, in the years since, the little sapling we transplanted has become a splendid tree nearly forty feet tall, with that combination of strength, grace and delicacy that is peculiarly a hemlock's. Its limbs are like arms extended in flowing sleeves, with the fingertips raised in benediction. I live far away now and have seen the tree only half a dozen times in perhaps twenty years, but it never fails to send a wave of emotion through me. Evoking with undiminished freshness a picture of two boys plodding solemnly along with their load past Harry Williams' pasture, where the Holstein herd stood in the long shadows after the milking and a catbird sang in the alders, it bridges the gulf of time as a living link with the long ago.

It was partly owing to the hemlock that, after my discharge from the Army at the end of World War II, I had a yearning to buy a bit of land within commuting distance of my job—enough land on which to grow some trees. It took a while to manage it, but eight years ago my wife and I found an old place in Virginia, outside of town. The first spring we set out 200 seedling conifers in a corner of the garden, although we had little idea of what we were going to do with such a host except watch them grow.

Young spruces and firs, which most of ours were, are greatly appealing, being fully formed, miniature replicas of what they will become, already symmetrical and sturdy little giantlets. Almost from the start you can see in them the spired armies darkening the mountain-

tops of the southern Appalachians and marching to the brink of the sea on the coast of Maine; when you handle them you can hear the keening of the winter wind in lofty branches, and smell the tonic fragrance of the summer breeze that stirs through the sun-warmed needles. Even before we had our place in the country I had acquired half a dozen little balsam firs and red spruces that I kept in pots in a southern window at my office. I had brought them back from Vermont in obedience to a kind of dumb impulse to hold on to all I could of the hillsides over which I had walked at dawn, drenched with dew from the waist down, torn by wild blackberry canes and uplifted by the singing of the olive-backed and hermit thrushes—singing of such haunting beauty that you felt the birds were merely the instru-

## But Anyone Can Plant a Tree

By CHARLTON OGBURN, Jr.

ments through which was voiced a universal and un-earthly rhapsody.

Not all the conifers are well adapted to the hot sun and clayey soil of Virginia, and the mortality among our seedlings was heavy, but we succeeded in saving considerably more than half of them. These are now handsome, proud little trees up to four feet tall. One of the spruces we planted in a metal drum, and we bring it indoors and decorate it each Christmas. An evergreen that is alive and growing seems to emanate joy and to be in keeping with the spirit of the occasion as no tree severed from its roots can be.

We have given trees to friends, sold them to strangers, and even supplied two nurseries—there being a limit, whether you like it or not, to the number of plants you can dig up and take with you when you move. The result is that trees we have raised now are scattered over a considerable part of Fairfax County. Among

them are Norway spruces, descendants of trees lining the fjords and lakes of Scandinavia and standing black against alpine glaciers; Engelmann spruces of the high Rockies, which sometimes reach an age of 600 years, and even longer-lived Douglas firs of the Rockies and Pacific Coast States, which are among the tallest trees in the world. (To know how it would feel to be at the top of one of the greatest of them, look out of the window the next time you find yourself on the thirtieth floor of a building.)

Some, at least, of the trees we have sent out into the world can be expected to escape what the suburban developers call progress and, gaining in stature year by year, provide in a remote future that which a great pin oak beside our house has given us; not only the sight of beauty and grandeur, but a sense of the continuity of life. This oak, about seventy feet high and not much less in spread, was planted or spared when the land was cleared more than a century ago by an individual with whom I have felt an intimate bond, unknown to me though he is. I think of him in connection with the lines of Henry Van Dyke's: "He that planteth a tree is a servant of God, / He provideth a kindness for many generations, / And faces that he hath not seen shall bless him."

To have the satisfaction of launching a tree upon its epochal life requires only a dooryard, perhaps only a sunny window. A man I once knew kept a bay tree in a city rooming-house, where, flourishing like the one in the *Book of Common Prayer*, it grew as tall as he before he had to find a home for it in a yard. Another friend of mine had an avocado tree in a great wooden tub in his office. It had been started as a seed in a tumbler of water, but grew to such a size that when its owner transferred to another agency a small van was required to move it.

In growing trees from seeds, the best procedure is patterned on Nature's. Some trees, like red and silver maples, elms and willows, have seeds that ripen in the spring, and if planted immediately will soon germinate. Most tree seeds, however, ripen in late summer and fall, and the usual practice with these is to free them from their pods or cones or any fruity pulp, and store them in a cool place until spring. (Keeping them in a sealed jar in the warmest part of the refrigerator generally works.) Acorns and other nuts are among the exceptions. They should be kept in moist sand or peat moss. In planting, the rule of thumb is to cover the seed to a depth of between two and four times its thickness—the looser the soil, the greater the depth. If planted in containers indoors and

given warmth of between 70 and 85 degrees during the day (night temperatures should be lower), seeds may germinate in advance of their normal season. Spring and fall are the normal times for transplanting.

Most good gardening books offer general instructions on growing plants from seed. A folder obtainable free from the U. S. Forest Service, Washington 25, D. C., entitled *How Man Starts New Forests*, gives brief directions for raising trees and, more importantly, the addresses of all State Foresters who can supply more specific directions applicable to the locality—and also information on where and how to get seedling trees. The Boy Scout Merit Badge Handbook, *Forestry*, prepared by the U. S. Forest Service, is a good introduction to the field and sells for twenty-five cents. For a full treatment of all branches of the subject, the 1949 Yearbook of the Department of Agriculture, *Trees*, which may be obtained postpaid from the U. S. Government Printing Office, Washington 25, D. C., for \$2.75, is outstanding.

We have germinated from the seed of a tree that stands near the Lincoln Memorial in Washington, D. C., a Himalayan pine of a kind beneath which Buddha rested, and trifoliate oranges redolent of the tropics.

You would not think citrus trees could survive as far north as Washington, but the parent of ours has grown to maturity on the Capitol grounds and our own young ones, out where winter temperatures run even lower, are thriving after coming through two spells of zero weather. One of them was the first of our trees to provide shelter for a bird's nest. To have a pair of field sparrows raise a brood in a tree you have grown from a seed gives you a feeling of having started something in the universe!

The two trees that have grown faster than any others are Sophoras, which in Japan are planted around religious shrines for their great domes of lacy foliage, and in China were known long ago for having put out their lovely panicles of creamy white pea-like flowers at the time of the Imperial examinations in late summer. The two English names given the species derive from those associations; Japanese pagoda tree and Chinese scholar tree. Ours grew from seed that my wife collected from a huge specimen in Farragut Square in Washington nine years ago, and were started in two-inch flower pots in an apartment. They are now fifteen feet tall, and were already flowering and fruiting the year before last.

Two trees that we started in much the same way, from acorns we picked up beneath a tree on the grounds of the Pan-American Union building in Washington, are much

## THE KNOTHOLE

*Unstilled sound in a tiny cavern,  
Buried beneath a cupful of water,  
Sends gentle tremors toward the surface.  
Once a week the rain comes in,  
Sluicing down through leaf and branch,  
To fill the bowl too wet for nest.*

*The tapping of the rain on bark  
And the hollow sound of caves  
Float across the moving water  
And disappear ashore.  
Tunneled pith, steeped in waves,  
Quells the melody in soft wood.*

*The sound is heard in the woods four-score,  
Till music and tree fill the forest floor.*

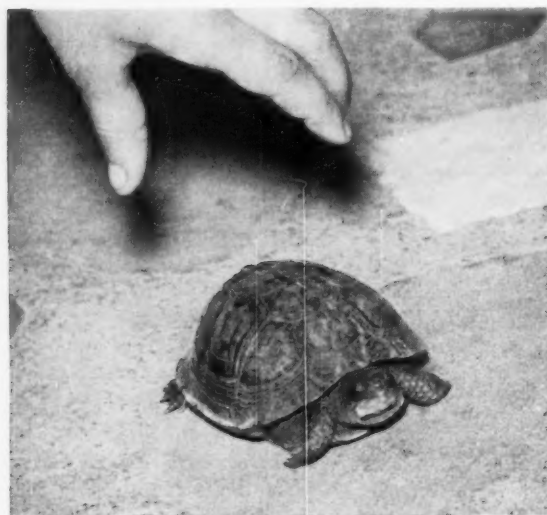
Millard Davis

slower-growing but are even more romantic in background, at least for Westerners. They are English oaks, and we should all rise at the pronouncement of their name, for it was the peerless timbers of *Quercus robur* that for centuries carried the navigators, traders and settlers of Western Europe across the seas to found the Americas and give the modern world its start. Some living members of the species in England probably have been alive since Saxon times. One, the "Great Newland Oak" of Gloucestershire, has a girth of forty-six feet.

Recently, in urging the need for all of us to invest less in personal indulgences and more in the general good, Walter Lippmann cited the example of a man planting a tree—from which he himself cannot hope to realize the benefits—as evidence of our faith that we are part of something greater than ourselves, something that came long before we did and will continue long after us. Our debt to the past is heavy and can be repaid only to posterity, as trees make us realize. No one who has experienced the lightening of heart that comes with the unfolding of leaf buds in the spring, who has sunk to the ground in the shade of a tree after working in the

summer sun, or been stirred by "a tall tree tossed by the autumn wind, and a white cloud riding high" can have failed to be aware of all he has to be grateful for and to desire to make a return.

The thrill of knowing that we have played an indispensable part in the coming into being of so noble a creation, that it is *our* tree, is doubtless a form of egoism. But surely it is one that we may be forgiven, as we may be forgiven for seeking in the planting of a tree a measure of fulfillment of the urge for immortality. A hemlock I once saw that had been felled to make way for a golf course in the mountains of North Carolina had more than 400 annual growth rings. It was of no great age, as age is counted among the redwoods and bristlecone pines of the West, but it was a century and more older than the oldest English settlement in America, and it was still sound and had been growing vigorously. It made me think that, with luck, the hemlock Sinclair and I planted long ago could be standing when ten generations of our descendants had come and gone, lifting the vision of its beholders and touching them with awe—as what great tree does not? ♣ ♣ ♣



## A Turtle that Comes to Breakfast

By NORMA A. BLIEM

Photograph by Darlene J. Heere

A three-generation pet of a Pennsylvania family is "Petty," a box turtle that, during warm weather, comes to the kitchen door for a breakfast of bread soaked in milk.

**B**OX TURTLES may attain an age of from thirty to sixty years, and a few may live even beyond that span, depending on their ability to resist the "lure of the open road," where they all too frequently may become targets for careless or speeding motorists.

One hardy representative of this species—long ago named "Petty"—has been a three-generation pet of the Arthur Sweinhart family of Boyertown, Pennsylvania. For more than thirty years it has been coming almost daily, during warm weather, to the family kitchen door for a routine breakfast of bread soaked in milk. According to Mr. Sweinhart's daughter, the turtle then

leaves "for parts unknown," where it stays until early the next morning. Except for two cracked sections on its carapace, or upper shell, the turtle has shown but little change over the years. Never a particularly colorful animal, "Petty" now is a bit darker in color.

With the approach of cool autumn days, the turtle disappears; but in the spring the happy shouts of Mr. Sweinhart's grandchildren, Kathy and Roy, herald the return of their loyal friend. Regardless of the calendar's date, the return of "Petty" is the opening day of Spring in this household, which hopes that "Petty" will really surprise the naturalists, and live to be a hundred!



When the mating season arrives, the male Richardson's grouse chooses a dancing-rock and performs a mating dance, with spread tail and extended orange-colored wattles.



## A Mountain Migrant

By ANDY RUSSELL

*Photographs by Richard Russell*

**E**ACH spring, about the time the first pasque flowers burst into bloom, an old friend arrives at our home at the foot of the Alberta Rockies. He is an interesting individual—a character of contrasts, who is sometimes a flamboyant show-off full of loud talk and self-importance, and at other times is shy and self-effacing.

Our mountain home is located in a scenic part of southwest Alberta, and overlooks a vast panorama of wilderness mountain country to the west and south. To the east, great reaches of prairie stretch to a horizon that is more than one hundred miles away on a clear day. It is the only place in the whole stretch of the Canadian Rockies where the prairies meet the mountains with no intervening band of foothills. Our ranch, bordering on Waterton Lakes National Park, is a favorite nesting ground of the Richardson's grouse, a strange migrant that travels east and west instead of north and south as most migrants do. The local residents call this bird the blue grouse, and in some places it is known as the sooty grouse.

The blue grouse is about twice the size of the better known ruffed grouse, and is second only to the sage hen, which is the largest of the North American grouse. Its predominant color is a rich charcoal gray. Although not nearly as big, Richardson's grouse undoubtedly would remind European naturalists of the black cock.

These mountain birds winter among the high ranges of the Pacific slope, and are found all through the southern areas of British Columbia as well as portions

of the northwestern States. Their migrations are not extensive, in my opinion, although but little is known about the extent of their travels. However, it is a well-known fact that the blue grouse that nest along a narrow strip of mountains and foothills on the east slopes of the Continental Divide in southern Alberta do not winter there. They migrate over the Divide to spend the cold winter months among the heavily timbered mountain ridges of British Columbia.

The cocks arrive first in the spring, and we can always time their coming by watching for the purple crocus blooms. For the first couple of weeks after their arrival, the cocks feed almost exclusively on the blooms of the purple crocus. Our first glimpse of the birds is usually the amusing sight of a big cock strutting proudly across our veranda with all his feathered finery glowing resplendently in the early morning sun. We protect the blue grouse on our ranch, so they are quite tame.

A few days later the sleek hens show up, and the mating season begins. The cocks locate their individual dancing-rocks, which are usually half-buried boulders on open knolls and hillsides. Following the ritualistic maneuvering of the mating dance, they spread their tails, extend the bright orange wattles that are located over each eye, and blow up the air sacks in their throats. This last ballooning of the throat opens up the feathers on each side of the neck like a grinning mouth, revealing a deep-red patch of skin that is bordered by a ring of white secondary feathers. With great aplomb and

dignity the cocks step up on top of their dancing rocks, where they proceed to give a series of deep grunts as they turn and bob and bow and scrape. As a challenge to other cocks on neighboring hills and knolls, they intermittently leap several feet into the air with a sharp, drumming clatter of wings. The dancing takes place at sunrise and sunset. The males do not concentrate in groups as do the sharptail and pinnated grouse.

The cocks usually precede the hens to the dancing grounds, and the preliminaries are spent warming up to the occasion and showing off to each other. When the hens arrive, the tempo increases. As a special variation



In this unusual photograph, a cock Richardson's grouse is performing his dance on the branches of a tree, rather than on top of a flat rock or half-buried boulder.

to impress the females, the cocks make quick charges towards them, draw up to sudden stop, and give a loud booming call that can be heard for several hundred yards on still air. This noise is made by the sudden expulsion of the air from the throat sacks in a sudden blast through the vocal cords.

The nesting is done in heavy brush thickets among the aspen groves. It is a highly secretive affair, and during the nesting season the birds are extremely shy. The hens hollow out a shallow bowl on the ground, which they line with dry grass and leaves. They lay between twelve and eighteen snow-white eggs in late May or early June, depending on the season. It is a great rarity with us to find a nest, for the birds hide them away in almost impenetrable thickets, and never leave their nests without camouflaging the eggs with artfully arranged leaves.

When the chicks are first hatched the females are often highly aggressive. A number of years ago my wife was attacked by a jealous mother blue grouse, and was

severely scratched and beaten about the head before she managed to get away.

The coveys stay together all summer, and by September the young birds are usually full-grown. During the summer and fall the young eat vegetation, insects and berries, and when the first snow comes they leave us just as suddenly as they came.

During September and October I often have encountered these birds among the high mountains along the Continental Divide that marks the British Columbia border. At that time the grouse stay on the timberline ridges, and seem to be very much at home in this often-snowy wilderness. There they feed largely on the nuts of the limber pine, a species of white pine bearing large cones. They also feed on blueberries and the berries of scrub juniper and kinnikinnick.

I suspect that the migrations are conducted in a kind of leap-frog fashion from west to east in the spring, and in reversed order in fall. I have observed these birds all through this mountain area during the summer.

In thirty-odd years of wilderness wanderings among the Canadian Rockies, I received my most hair-raising thrill in a strange and unexpected adventure involving a big cock grouse.

One late July afternoon, we were riding along a high timberline trail on a sightseeing trip with a family party of guests from the East. On a steep slope among some alpine meadows at the foot of a high pass, we spotted a big sow grizzly and two cubs feeding in the open. We skirted the slope above her to give the guests a chance to view the silvertips. The big sow was quite unconcerned about us. After a casual look and a monumental sniff or two, she ambled off, paying us no further attention. One of our guests was a camera fan of the first order, and he was beside himself with excitement and a desire to get some pictures. I was firm in my refusal, but offered to try to get him some movie footage with his camera. The offer was accepted, and I set out after the grizzly mother and cubs that were just disappearing through a narrow belt of timber.

The bears were going slowly, feeding as they crossed a series of narrow, clean-swept avalanche tracks that were divided by strips of standing timber running up and down the slopes. The meadows were rank with the lush vegetation of early summer, so the tracks of the grizzlies were easy to follow. I knew the bears were just ahead of me, although the folds of ground kept them hidden. Cautiously I crossed one meadow and eased through a timber strip to the next one. The bears were still out of my sight. I was a bit on edge, for armed as I was with only a movie camera, fraternizing with a mother grizzly with two cubs is a practise not conducive to the attainment of ripe old age. However, I felt the chances were in my favor on this occasion, for the country was fairly open and I was confident of seeing the mother bear before she saw me. I also took some comfort from the scattering of climbable trees on the slopes.

With tension building up with (Continued on page 274)

## CAT

*An icy flame is often in his eyes,  
An ancient ghostglow of forgotten things  
Once seen by torchlight under other skies,  
Where all his ancestors were more than kings.  
Perhaps he can recall another land,  
Perhaps some curtain on his memory lifts  
To show again the ageless desert sand,  
The streets of Thebes, the worshippers with gifts.*

*No pet is this, this regal thing who dreams  
Relaxed on some warm portion of your floor.  
He once ran rampant through the royal themes  
Of kingdoms that the dust has claimed once more.*

*No pet is this, this guest who dreams alone  
Of bygone glory and a long-lost throne. . .*

A. Kulik



He has enriched the languages of men.

WHEN most of us hear the word "cat" we think of *Felis* more or less *domestica*, or an even wilder relative like the lion, tiger, or lynx. The polecat (from the French *poule* plus "cat," and of the genus *Putorius*) is something else again, and a highly pungent something when disturbed. No wonder that, after knowing this weasel-ferret in Europe, our ancestors, on landing in New England, called the first skunk they met a polecat!

But there are more than a hundred other cats, and no other animal has so enriched our language—particularly the specialized language of naturalists and seafaring men. It is the first of these two categories that we will consider here.

Cat's-head can be a large green cooking apple or, locally in Ireland, a nodule of gritstone in shale. In different parts of England, cat's-brain may describe a soil of coarse clay and stones, or a sandstone traversed by fine streaks of calcite.

The cateye is a large, spiny, brilliant-red fish of the North Atlantic that can be found in deep water from New York to Cape Hatteras. Cat's-eye is a gemstone that, cut *en cabochon*—or head-shaped—shows a line of light across its dome. But in Australia cat's-eye is something else entirely; it is the operculum of a marine mollusk.

Cat's-ear has a long history in the Old World, where it is allied to and resembles the hawkweed, but with its hairy basal leaves shaped like those of the dandelion.

## The Family of *Felis*

By GILEAN DOUGLAS

Photograph by Richard B. Fischer

The name also is applied to the hawkweeds of this country, and locally to any of several plants with leaves that suggest a cat's ear. Several species of *Antennaria*, or pussy-toes, and one of the plants known as everlasting have acquired this name.

Cat's nose is a popular name for the stormy northwest wind of the Harz Mountains of Germany. In the north of England the woodpecker is called catbill. In South Africa the cat-chop, *Mesembryanthemum felinum*, spreads golden over rocky outcroppings on the veldt. Catface is a knot or blemish on lumber, and cat's-tongue a strap oyster, slender and worthless. Cows and horses may be cat-hammed, having hams like cats.

A catspaw breeze ruffles the water just enough to give it that look called cat-skin. But in Tasmania, catspaw is a plant of the amaranth family. In China you may find the cat's-claw, a twining, fabaceous vine bearing

white flowers. In tropical South America the cat's-claw is a common yellow climber; in the West Indies it is an evergreen mimosaceous tree. Cat-cluke (or claw) as a name for birds'-foot trefoil has, I believe, disappeared from local usage, although you sometimes hear this plant called cat-in-clover. Cat's-foot is the ground ivy, but in zoology "cat-footed" means having digitigrade feet with retractible claws from which come that soft and stealthy tread we know as cat-foot.

Catgut is not only the strong, slender cord made from the dried intestines of sheep and other mammals, essential to violinists, tennis players and surgeons. It is also a perennial herb, *Cracca virginiana*, that is found in our eastern States and sometimes called goat's rue.

The cat-tails of marsh and lake border are a familiar sight, but to a farmer the word also might mean a form of cirrus cloud. In England, cat's tail can signify both timothy and horsetail, or equisetum. Cattail Peak, a 6600-foot mountain in North Carolina, is said to have received its name because of its catkin-bearing trees, as catkins often are called cat-tails in those parts. The Catskill Mountains of New York State, by the way, are not so called because they once killed cats there, but to indicate certain rock strata typical of the area.

So there is pussy from head to tail; but that is less than half the story of the cat's place in language. The various large hooting owls, especially the barred owl, are frequently known as cat-owls in country places. In Ireland the pine marten is a cat-crann, and everywhere that slaty mocking-thrush with black cap and tail and reddish under tail-coverts is called the catbird. In Australia there are the spotted catbird and the tooth-billed catbird—the latter with a cry hardly distinguishable from that of puss annoyed. In Scotland the jackdaw is a cat-hag; but a cat-thrasher was not a bird at all. It was a local expression for alewife in early America.

The cat-tree is the spindle-tree, and the cat-whistle the marsh horsetail. Both mountain holly and the common gooseberry are called catberry locally, and in England the haw or fruit of the hawthorn is cat-haw. The catmon tree, with its heavy wood resembling rosewood, is a feature of the landscape and industry of the Philippines. In India the seeds of the catjang are an article of food. The willow in bloom is called catkined, and the ash catkeyed. Most of us know catnip—also called catmint and catwort, beloved by catlings and their parents—but not so many of us may have seen the succory herb called catnache, or have been aware that the sheathed cotton-grass also is called cat-locks.

The smilax often is termed cat-brier here, and in

England the sun spurge goes under the common names of cat's-grass and cat's-milk. The cat spruce is the white spruce. The cat family has planted itself firmly in our language, and its fame has spread not only through earth and air, but through water, too.

The name catfish recalls many memories, like digging for worms on a grass-scented summer night, a morning river and a pole cut from a willow tree. There were other fish in that river, but only the bullheads or catfish seemed to come my way, and that was quite all right with me. I could see the barbels about their mouths—that might be said to look like cat's whiskers—and I told myself that I could hear the "purr" when a catfish was caught.

I did not know then that this fish had many names, such as stone-cat, mud-cat, channel-cat, sea-cat and Bashaw cat of the long jaws, or that the blue catfish of the Mississippi can weigh more than 100 pounds. There is the Great Lakes catfish, the yellow willow catfish of Louisiana and the blind catfish of Pennsylvania, which has atrophied eyes and is found in caverns. The brown cat is the fish of Carolina and Georgia. In Bermuda the catfish is sometimes called the rabbit-fish. In England it might be the logfish, cusk, angler or weever, depending on where it is found. The only other fish on which *Felis* seems to have left a claw mark is the cat-shark, *Triakis semifasciatus*, common off the coast of California.

Catamount—it used to be catamountain, for cat of the mountain—as a name for the panther or cougar often was used by prose writers of the last century, and in his *Hunter of the Prairies*, William Cullen Bryant tells of: "The brinded catamount that lies / High in the boughs to watch his prey." The northern fox-squirrel and the southern variety of the gray squirrel both are known as cat-squirrel, and so is the cacomixtle or ringtail, that raccoon-like carnivore found in Mexico and in the States bordering that country.

The thin ice left over grassland or shallows when the water has receded is called cat-ice. Catscaup is a local name in England for a nodule of ironstone. In olden days a mica with a silvery luster used to be known as cat silver, and today amateur prospectors still are being fooled by that yellowish mineral called iron pyrites, or fool's gold—or sometimes cat-gold. Those who call the big tractors "cats" are right, for caterpillar comes from the word cat plus *pilus*, or hair.

So here are some sixty members of the nature branch of the cat family in language. There are as many more in the speech of doctors, sailors, loggers, thieves, gamblers and just plain you and me. A good name for it all might be caterwauling!





# Getting Acquainted with Wild Things

By HELEN HOOVER



"There is one chipmunk that regularly hops on the toe of my boot, eager to be fed."

EVERY SO often someone says of me: "She has all kinds of tame wild animals." Now, obviously an animal cannot be tame and wild at the same time; but it is true that the cabin on Gunflint Lake in Minnesota, where my husband and I live, is a gathering place for wild things—red squirrels, chipmunks, weasels, foxes, deer, many birds, and even fishers, the wildest and shyest of all. And some of these come regularly to accept food from our hands. This is not accidental.

When you live in the deep North Woods, as we do—many miles from your nearest human neighbor—you become quite conscious of your wild neighbors. You may be sure that your comings and goings are watched by creatures large and small, feathered and furred, that peer from the bush, tensed and ready for withdrawal until they are sure that you are going about your own business. In winter you see the lacy trail of a deer mouse across the snow on the path, the big hind-foot marks of a snowshoe hare, the pigeon-toed triangles of a ruffed grouse. If you are interested in wild things at all, you will want to see the visitors. If, like me, you find them as interesting as humans, you will make every effort to get acquainted with them.

By "getting acquainted," I do not mean training or taming the animal so that it loses its native caution

is a kindness to do all you can for a lost baby mammal or bird, and it will repay you with devotion; but it is not best for the animal to be trained into domesticity. In any case, it will lack its mother's wise counsel on searching for food and avoiding enemies. When the animal matures, the wild will call, and if it is too dependent, it will have a poor chance for survival after leaving its human foster parents to live alone. I see no excuse for acquiring, for example, a baby fox and rearing it as a pet. There are plenty of domestic mammals that are bred as house pets.

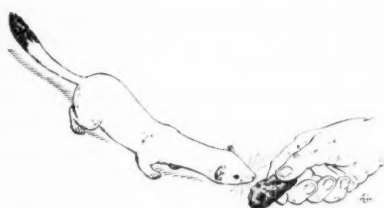
I mean by "getting acquainted" the persuading of adult wild things to accept you as a harmless, beneficial part of their environments. Under such conditions you can see the animal as it is, observe many "tricks" of its own devising, and learn that animals, like humans, show marked personality differences. You must use common sense in doing this. I have met several people who would like to know their animal neighbors better, but fail utterly because they do not think about such neighbors properly.

During the time of heavy snow, when browse is hard to find, deer come regularly to feed on cedar branches cut for them by a young couple that I know. While the deer are feeding the girl waves her arms in the windows, shouts, or thumps on the glass. The deer continue to feed, keeping a watch in the direction of the disturbance; but they bound into the woods if she so much as opens a door. This, the girl thinks, is most peculiar. *She* knows that she has no intention of harming the deer—but the deer do not.

A summer home owner has landscaped his grounds with small cedar trees. Every winter the deer eat most of the cedar branches, and every spring the man shouts that those deer had better learn that the trees are his, and stop eating them!

These people have forgotten that, while humans are a particular species of animal, wild animals are not human, and communication must be on the animal's plane of understanding. The girl should stop her menacing actions. The man should set off his trees with high wire fence.

Last summer a steak disappeared from the counter of a summer visitor's kitchen. Several days later, the mystified housewife found the sadly-deteriorated meat



"The ermine . . . took his meat from my fingers with care and daintiness."

Illustrations by  
Adrian Hoover

or takes up an artificial way of life. If an animal is confined and adjusts itself to confinement it is no longer a wild animal, but a sort of hybrid between wild and domestic creatures. If it is confined and does not adjust, it is a miserable and rebellious prisoner. If it is conditioned to perform on signal, the animal may do astonishing things in the entertainment line, but it wears a clown-mask over its defeated natural dignity. People who handle wild things in such ways can not know their true natures and abilities.

I do not refer to rearing infant wild things, either. It

lying under a cabinet beside a knothole that was large enough for a weasel but not for a steak. Her husband thought that the weasel, with his brown coat and white vest and stockings, would be an unusual pet, so he set a box trap, into which the unsuspecting weasel promptly walked.

These people were told that weasels do not adjust to confinement, but they thought that in some way they could change this. The weasel ate what was given it and spent its waking hours in giving vent to squeaks of fury while it tore desperately at the confining wire mesh. A little boy who came to visit looked at the pitiful, weary captive, bloody of paws and mouth. He opened the cage door and watched the weasel streak away. "He wanted out," the boy explained, with the patience that children use on adults who seem dim of comprehension.

So here is another element in the art of living as good neighbors to wild things; they "want out," and they cannot accept your overtures unless they understand them.

Basically, getting acquainted with wild things depends on teaching them to trust you. But *you* must provide the conditions and let the mammals and birds learn for themselves. First and most important, *you must trust them*. If you are hostile, or nervous, or afraid, they will sense your tension and keep their distance. Next you must consider the time of year, and decide which animals are most likely to be attracted. Then you must supply suitable food as an inducement. There is no sense in flattering yourself with the notion that they come to you just because they like you. Finally, you must work and wait with infinite patience, remembering that your wild neighbor's native caution is its first line of defense.

As a general example, I shall draw on my own experience. The chipmunk and the Canada jay are representative of the "tamest" animals, the weasel a representative of the wildest ones. It might be said at this point that wild mammals and birds that will come to the hand are the exceptions rather than the rule.

During the spring and summer, when the woods are full of young things, few wild creatures will add the hazards of human association to those that are unavoidable. The chipmunks are an exception. In the northern part of Minnesota we have two species; the least chipmunk, which is small and slender, with stripings all the way from nose to tail, and the Eastern chipmunk, which is larger and plumper, with stripings that end at its rump. Both of these chipmunks are fond of cracked corn, and will readily come to a supply that is left in a convenient place.

Our chipmunks live in burrows under the stones of our garden wall, so I leave the corn on the patio flagstones a few feet from the wall. After the chipmunks are

familiar with the location of the corn, I make it my business to put corn there when they can see me, and remain outside to let them become familiar with my presence. At first I stand motionless. Then I move my head and hands a little, and later walk slowly about. After the chipmunks have accepted this, I hold some corn in my hand and sit, with my fingers resting on the stone where I have been leaving the food. An Eastern chipmunk eventually may come cautiously over and snatch a sample. After this it rapidly learns to greet me when I come through the door. There is one chipmunk that regularly hops on the toe of my boot, eager to be fed. The least chipmunk is more cautious, and rarely approaches closely. In September and October, when the chipmunks are storing food for the winter and have no

family responsibilities, they are quite friendly. We keep plenty of corn on hand, because they can stuff an amazing quantity into their bulging cheek pouches.

I never have attempted to do more with nesting birds than to put out feeders for their convenience. Their summer shyness is well advised, as there are many dangers to their eggs and young. But in late fall, the year-around birds come to spend the winter with us and to feed on suet in little cages of half-inch wire mesh, bacon rind nailed to trees, the usual cracked corn, and bird seed. We can

count on Canada and blue jays, downy and hairy woodpeckers, Acadian and black-capped chickadees, rose-breasted nuthatches, and many transients that come and go through the snowy months.

Of these transients, the Canada jays, usually called whiskey-jacks in our vicinity, are the friendliest. They are beautiful, robin-sized birds, all in blending tones of gray with black heads and off-white faces. Unlike the blue jays the Canada jays are not crested, and have gentle, soft voices. A family of four comes to our cabin door every morning for pancakes!

At first, we tossed pieces on the snow for the jays to pick up. Then I stood in the doorway with the food on my steady, outstretched hand. Birds, like people, have leaders and followers. In a few minutes one of the jacks snapped up a piece of pancake on the fly. An hour later it was perched calmly on my fingertips, while two others of the family were learning to drop down to my hand from overhanging branches and the edge of the roof. The fourth bird has never decided that I am safe to touch, and takes its share from a little shelf beside the door.

These birds rapidly developed methods of attracting our attention. They perch in the windows and tap on the glass with their beaks. They light on the little shelf and flap their wings. But they are most appealing when they sit on the snowy branches, with their feathers fluffed against the cold, chirping (*Continued on page 274*)



The birds are most appealing when they sit on the snowy branches, chirping wistfully.

# Know Your Funguses

By E. LAURENCE PALMER

*Illustrations by Elizabeth Burckmyer*

*This is the 101st of NATURE MAGAZINE's special educational inserts.*



Corn Smut



Ergot

THE statement in the title of this article is made without reservation and with emphasis. There is probably nothing—between Sputnik-explored outer space and the Nautilus-probed depths of the sea—more important to man's happiness and welfare than the funguses. There is relatively little in common between their botany, that I learned as a student a half-century ago, and what is now known and taught about them. This is no reflection on a course I took at the graduate level under George F. Atkinson, a leading student and teacher in the field of mycol-

ogy. It is just that the field has grown far beyond where anyone imagined it might grow. It has grown thus because it has called into its fold geneticists, physiologists, pathologists, chemists, physicists, industrialists, engineers, financiers, educators, writers and almost every element of human society capable of effecting worthy changes.

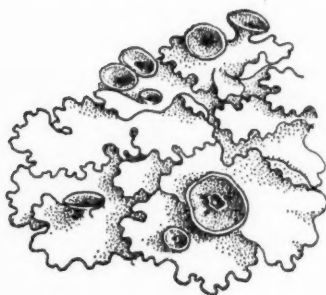
Personally I owe much to this development, and am sure that I would have died within the past decade had we known no more about funguses than we did a generation ago. I am equally confident that I would not have lost a son nearly twenty years ago had we known what we knew a decade after his death. To me at least, funguses have had a real impact on life. I believe that

what we learn of them in the next few decades may well revolutionize our lives even more than has what we learned in a similar period in the past. To me at least, funguses are of paramount importance, and one of my major regrets is that, while I well remember seeing what Fleming, the discoverer of penicillin, saw, I wholly lacked his ability to interpret and to profit by what he saw.

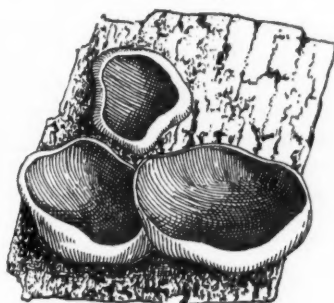
In this article, we can only introduce you to a few funguses that may be of interest. From six recognized groups of funguses, we introduce representatives of three. We do not consider the bacteria, the slime molds, or the imperfect funguses. We discuss two representatives—the water molds and the bread molds—from the algal funguses and molds, the Class Phycomycetes. From the sac funguses—Ascomycetes—which include the yeasts, mildews and lichens, we present five out of 40,000 recognized species. These are the beautiful scarlet cup found on old twigs in spring in the forest floor, ergot found in grass heads during the summer, black-knot which deforms plum and cherry twigs the year around, and two common lichens representative of the reindeer mosses that make arctic regions habitable. The remaining species are members of the Class Basidiomycetes. These challenge our interest, our economy, our intellects, and sometimes our appetites because, in many instances, their food needs clash with our food and other material necessities.

The thirty-first unit of this series, published in 1945, dealt with the mushrooms and toadstools. No fungus

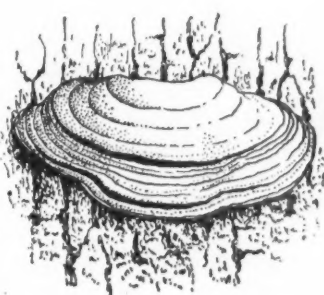
Parmelia



Scarlet Cup

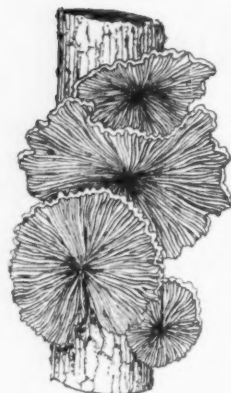


White Buttrot

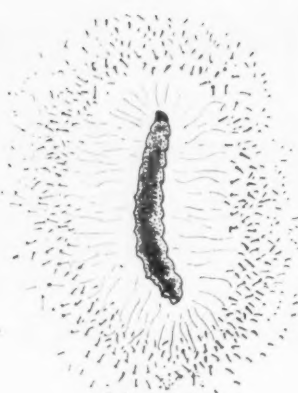




Inky-cap Mushroom



Schizophyllum



Water Mold

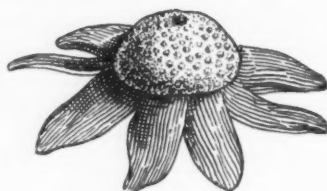


Cedar Apple

considered there is dealt with here. The thirty-six species presented in the two units can hardly be considered as fully representative of the more than 70,000 kinds of fungi recognized by scientists, plus the greater number that no doubt remain undiscovered today. Only six of the eighteen species presented are ordinarily associated directly with disease, and only one of these might be considered as directly responsible for diseases in animals. On the whole, the species involved are just those that might challenge the inquiries of an ordinarily inquisitive person.

There is no season in the year, and practically no place on earth where, if one knows how, he cannot without expense or effort get at least one of these fungi for direct study in a relatively short time. A piece of bread may mold in a bread box. A fish may die in an aquarium. A walk in a forest or along a street may disclose shelf fungi on the trunks of trees, or a cup fungus on trash on the forest floor. A walk through a field or waste spot may show some ergot in a head of such a grass as wild rye. Even a stroll through a cemetery may reveal a few monuments on which some lichens are successfully growing. Indeed, it might be difficult to find any place where some of these plants cannot be found. Even old books or old shoes may support some of the mildews.

Since so many persons enjoy stocking small terrariums with little plants and animals, we chose a few lichens that have superior merit in such places. These, too, represent that interesting situation where a fungus and an alga live together with profit to each, a symbiotic relationship. Then, too, we selected some species that live in dead plant material and are considered as saprophytes, and some in which the fungus feeds on a living organism as a parasite and in so doing destroys the host. Despite what you might casually think, each of these relationships may be sometimes useful. The saprophyte destroys dead material, making space for the growth of new organisms. "The old must make way for the new,"



Earth-star

as the television commercial tells us. The parasite may function effectively in killing old trees whose growth and reproductive capacity do not represent the best returns that might be expected from the space they occupy. On the whole, of course, fungi are dependent on other organisms for their basic food, but this is also true of all animals as well. Some of

the simpler fungi have the ability to do such important things as to fix nitrogen and to fix sulphur, but they do not produce carbohydrates as do the green plants.

The accompanying chart material will give a few details on the specific differences in the fungi presented, but unless this encourages the reading of such books as *Microbe Hunters*, *Miracles from Microbes*, *Men Against Death*, *Hidden Hunger*, or some of the basic books on plant pathology and fungi, or the most modern books on general botany written by the pioneers in the field, it will not be the success that is hoped.

The life history of a fungus plant cannot be presented in the space here available, and I could not give it for all kinds even if I wished. As a matter of fact, no one could give it for all, since it is not known. There is a splendid opportunity for any serious student to make a successful professional and economic life studying these plants, and few fields offer greater prospects of reward than are here present.

Basically, the life of a fungus consists of the growth and development of the plant body or mycelium and the production by that mycelium of spores that will start new mycelia to perpetuate the species. In such plants as the yeasts, this may consist essentially of the budding of the plant body, the separation of the buds from the parent body and the development of the freed bud into an individual like the parent. This is almost too simple, but, in reality, the chemical changes produced by that simple process are of overwhelming importance. We cannot go into that here. Neither can we consider seriously the mycelia of other fungi, which, in the case



of the woodrots, may extend through the trunks of our tallest trees. Ordinarily, so long as there is food and suitable climatic conditions the mycelium may continue to grow in many funguses almost indefinitely. When conditions change, thus altering availability of food, water and suitable temperature, then the fungus plant is likely to do something other than develop its mycelium. In fact, these changes may take place anyway, in the presence of abundant food, ideal climatic conditions and with no inhibiting circumstances.

The production of spores from the basic mycelium is often an amazingly complicated process. The spores may be merely resting stages. They may be involved in the commoner types of asexual reproduction. They may be of different strains, which behave as though they were sexual without apparent differences other than those of behavior. And they may be truly sexual with elaborate structures developing to assure their reproduction. Conditions may require that more than one host, or more than one kind of host, be involved in completing the life cycle. Under these circumstances, it is not surprising that before these associations were recognized different species names may have been applied to various stages in the life cycle of a given fungus. Our unit here introduces you to a few of the funguses having some of these characteristics. If you were the old-fashioned botanist of a few decades back, you would have been satisfied with recognizing the differences in the different kinds of funguses. This usually implied some knowledge of life history, and this study of the natural history of the fungus usually led to the recognition of previously unsuspected roles that were being played. Since many of these roles affected the pocketbooks of men, and since many of these roles were destructive to man's interests, it became worthwhile to solve the secrets associated with the lives of the funguses. Liberal private and government subsidies have been made available to help in the study of those among these plants that affect the storage and sale values of perishable vegetables, and other foodstuffs. Where the production of a staple food in a nation does not approach the dietary needs of that nation, and where funguses may figure in that deficiency, dedicated scientists and social workers may contribute inspired services to the control of those growths.

While I find frequent references in *The Bible* to the de-

struction of materials valuable to man made by insects, I find little reference to such damages caused by funguses. We do read of manna, which was reputed to come down from heaven, but it is quite probable that this refers to some lichen growths that the Israelites used as food during their wanderings in the desert. Manna was called "corn of heaven" and "angel's food," and since hoarding it was not permitted it served as a basis for a socialistic practice in the handling of perishable food. It is believed that each man was permitted to gather each day three quarts of this emergency food.

The poets and the producers of the world's finest literature have used funguses to develop an idea. Usually, this has not been to the credit of the fungus. The words mold, mildew, fungus, rot, smut, rust, blight and scab do not ordinarily have pleasant connotations and yet each of these words refers to one or more funguses that, broadly understood, perform some useful function. The possible existence of funguses is frequently implied but not specifically acknowledged. Pope, in his "Essay on Man," for example, says of man that he is:

"Tis'd like a plant on his peculiar spot,  
To draw nutrition, propagate  
and rot."

Rotting implies the presence of a decay organism, which might well be a fungus. Shakespeare, in *Hamlet*, gave us the often-used expression about things being "rot-

(Continued on page 256)

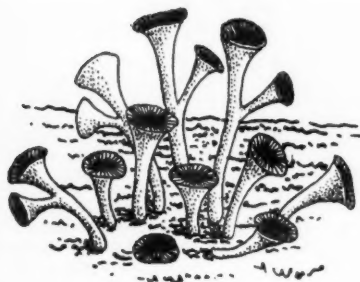
Stink-horn



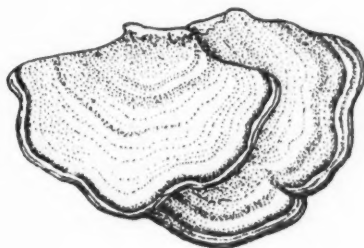
Black knot of Plum



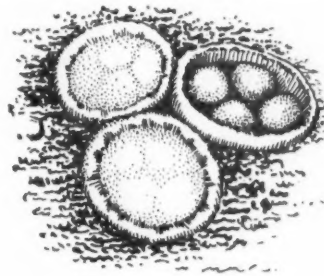
British Soldiers



Silver-leaf Disease



Bird's-nest Fungus



COMMON NAME SCIENTIFIC NAME	WATER MOLD <i>Saprolegnia</i> sp.	BREAD MOLD, SOFT ROT <i>Rhizopus nigricans</i>	SCARLET CUP <i>Peziza coccinea</i>	ERGOT <i>Claviceps purpurea</i>
DESCRIPTION	Most commonly appears as a white fuzz, or opaque white tissue, on dead or diseased animals in almost any natural waterway. Commonly forms where tissue has been bruised. Appears under microscope as a mass of filaments, without crosswalls and, unlike most fungous tissue, giving the reactions of true plant cellulose, in some respects being like some algae.	Common on old stale bread. May cause a soft rot on sweet potatoes in storage, producing a crowded mass of white filamentous threads that produce spores. May produce ring-rot, which is in a way a development phase of the infected area, the reproductive area and the resultant destroyed tissue including resistant areas.	Appears like flesh-colored "ears" to 2 inches across, with brilliant scarlet interior. Found growing on decaying sticks under loose cover in open or in woodland in late winter or early spring. As season progresses scarlet turns to black and whole structure becomes withered and relatively inconspicuous.	Some fruits in heads of rye, barley, wheat and other grasses may develop hard, black or brown, curved cylindrical structures that look like large "fruits." These fruiting bodies have developed from the grass fruits that have been destroyed by the fungus, ergot. The ergot replaces the entire grain and a number may appear in each head. Has noticeable odor.
RANGE AND RELATIONSHIP	Class Phycomycetes. Order Saprolegniales. Family Saprolegniaceae. Found widely distributed in spore form, mostly in water but sometimes in soil that is wet, or even on terrestrial animals under certain conditions. Commonly follows infection by bacteria and protozoans of animal tissue that has been injured, weakened or affected by disease or malnutrition.	Class Phycomycetes. Order Mucorales. Mucoraceae. Mostly saprophytic and associated with rich starches and sugars. At least 150 species recognized, and many strains with varying properties exist. Often defined as black mold because of blackness of spore producing areas. Closely related forms on many vegetables.	Class Ascomycetes. Order Pezizales. Family Pezizaceae. The class includes about 40,000 species or about 1/2 the entire number of fungi. In this group, the threads have crosswalls unlike those of the Class Phycomycetes. The group includes the yeasts, many of the mildews, the lichens and other important groups.	Class Ascomycetes. Order Hypocreales. Family Hypocreaceae. This disease organism is world-wide in distribution wherever the host grasses may grow. It is one of the oldest known plant diseases, with the drug being used before the nature of the disease was definitely understood, first in 1863.
REPRODUCTION	May increase in volume simply by rapid growth. May produce asexual spores in club-shaped sacs at end of filaments. These swim to other tissue and may cause infection. Or may have other asexual types. Sexual reproduction involves different sized spores, but true fertilization is questioned; rather, unfertilized egg develops after resting stage.	Basic tissue or mycelium penetrates affected areas of host and may then produce surface mold, which, in turn, produces erect stems capped with black spore cases, which burst, freeing spores into air and carrying spores to new tissues. Should recognize resistant corky tissue often developed by living tissue of sweet potato, for example, when invasion is in progress.	If tapped, the scarlet "ears" may be seen to give off clouds of fine spores, if the plants have been left undisturbed in a warm dry room. Unlike in the mildews, they are not enclosed in cases. In some members of the group, the sac fruits are developed as a result of a sexual process. The cups, inner surfaces of which bear the spores, may be yellow, orange, blue or even black.	Winters in diseased fruit or "sclerotia," which, after a month of freezing, may produce structures at between 59 and 64° F. These can be blown or carried to grass flower. Flower is susceptible to attack for short time only when flowers are open. Then comes a stage that oozes sticky spore units, which may be carried by insects or otherwise, spreading infection.
ECOLOGY	Common treatment involves bathing in 3% salt solution or flushing with 1/15,000 solution of malachite green, or 2 grams malachite green to 1 gallon of water giving treatment every other day. Others recommend 1/200,000 solution of malachite green for an hour. Others recommend solutions of copper sulphate or of formalin. Best treatment is to practice sanitation.	Growth is between 42 and 98°F., with optimum at 91-97°. Spores form at between 50 and 86°F. and spore germination at from 32-86°F. Optimum humidity is at 71°F. at 75-84%. In development, proteoglycanase is produced, which tends to break down the cell walls of the host plant by dissolving the middle of the wall.	The scarlet cup is essentially a useful species, serving to speed the destruction of dead wood to make space for new growing plants. The plants are saprophytes not parasites and live on dead organic tissue not on living material. Diseases caused by members of the group Ascomycetes include peach leaf-curl, powdery mildews, elm disease, apple scab, chestnut blight.	The stage originally described above follows the sticky stage and may represent the wintering stage. Ergot-free seed makes the best control. In 20% salt solution, the lighter ergot infested fruits rise while the healthy fruits sink. Ergot may then be skimmed off. Fortunately, the conspicuously large, curved, infected fruits are easily identified.
ECONOMY	Apparently cannot develop on normal healthy tissue unless some foreign matter adheres. May be epidemic in fish hatcheries. Too common on crowded goldfish. One kind may affect roots of peas. At least 100 species in 16 genera. <i>S. parasitica</i> attacks injured tissues, while <i>S. invaderis</i> may attack healthy tissue, even internally killing apparently healthy hosts.	Control is by encouraging development of cork tissue in stored sweet potatoes by raising temperature for 2 weeks to 82-90°F. to allow cork tissue to develop over injured areas and then lowering, but not to below 41°F. This mold may cause tragic losses in stored vegetables and is considered one of the worst for sweet potatoes.	Control of scarlet cup is probably neither necessary nor desirable, since it performs a useful function. The members of the group are affected largely by humidity and temperature, and, if the limits of activity are known, the necessary control measures might be worked out. Removal and destruction of fruit bodies may sometimes be useful if control is desired.	Ergot may cause alkaloid poisoning of humans who eat flour made from infected grain. Infectious stage often most abundant along field borders where infections came from wild grasses. Cutting borders before harvest may reduce amount of dangerous grain in harvest. Disease may cause abortion and serious lesions in cattle feeding on ergot. Has medicinal uses.

BLACK KNOT OF PLUM <i>Dibotryon morbosum</i>	PARMELIA. ROCK TRIPE <i>Parmelia</i> sp.	SCARLET-CRESTED CLADONIA. BRITISH SOLDIERS <i>Cladonia cristatella</i>	CORN SMUT <i>Ustilago maydis</i>	CEDAR APPLE, APPLE RUST <i>Gymnosporangium juniperi virginianae</i>
Appears like long swollen, roughened, black distortions on the twigs and branches of plums, the distorted areas extending to 12 inches long and sometimes surrounding the twig or branch. May also be found on cherries. Color changes from olive in early stages through brown to gray and to coal black, texture changing from soft to brittle.	This is a lichen. Lichens are combinations of fungi and algae, the algae having the ability to manufacture food with the fungus providing moisture and stable position of the algae. The relationship is a true symbiosis in which each organism profits by association with the other without being parasitic in effect. <i>Parmelia</i> is found widely on rocks and bark.	An irregularly fragmented broken base produces a number of erect, branching, hollow, red-tipped fruiting bodies. Like <i>Parmelia</i> , this is a lichen composed of an association of algae and fungi, of which the fungus is the more obvious, at least during the fruiting season. Related species present a great variety of forms and of colors.	Appears as glistering, greenish-white membrane on any part of corn plant. Gall may be to 6 inches in diameter and ruptures to free mass of powdery black spores. Ears are most vulnerable and galls on young plants or above ears are most destructive. Galls on leaves are rarely larger than a pea and may disappear.	Appears on two hosts, red cedar and apple. On red cedar, appears at apple blossom time as masses of tendrils of bright orange-yellow, many times the size of the brown galls, which appear like small apples on the stems of cedar twigs as illustrated. The apple stage appears as yellow rust spots on the upper surface of the apple leaves.
Class Ascomycetes. Order Dothidiales. Family Dothidiaceae. Since all varieties of plums and cherries may have the disease the distribution is almost worldwide. The group sometimes known as the knot and wart fungi include the organisms causing the sooty spot or black mold disease of clovers, including at least 4 species of clover hosts.	Fungi are Ascomycetes and algae belong to family Protococcaceae. Since the fungi are the more conspicuous, the lichens are usually classified according to the nature of the associated fungus. Classification is most commonly through fungi fruiting bodies but includes types that are flat sheets, hanging threads, and erect structures as in <i>Cladonia</i> .	Fungus is an Ascomycete and the alga one of the Protococcaceae. In the genus <i>Cladonia</i> are reindeer lichen, <i>C. rangiferi</i> , a mass of gray branches; the scarlet-tipped <i>C. cristatella</i> ; the brown-tipped <i>C. mitrula</i> , and the gray-gobletted <i>C. pyxidata</i> , all for the most part at their best in late winter or early spring.	Class Basidiomycetes. Order Ustilaginales. Family Ustilaginaceae. Occurs in Europe, Asia, Africa, Australia and the Americas. Was identified in Europe in 1754 and in United States in 1822. Is often abundant in the Corn Belt of the United States and may reach greatest development on corn grown on heavily manured soils.	Class Basidiomycetes. Order Uredinales. Family Pucciniaceae. Disease and fungus requires presence of both apple and red cedar hosts. Similar but not identical host cycles involve cedar and hawthorn and cedar and quince, <i>G. globosum</i> and <i>G. clavipes</i> respectively. True function of rust spot stage ties insects into a sexual reproduction story.
Mature warty structures include cavities lined with structures that free spores into the air. Spores are blown to other hosts and attack wounded areas on the host trees to start the cycle over again. The reproductive areas may represent a degenerate sexual stage. Gummy spots may develop, which may figure in spread of spores.	Appears like sheets of leatherlike substance attached to soil or trees or rock by blackish "roots." If torn, interior will be seen to be white. Sometimes appears powdery when reproductive units are freed, or may center reproduction in shallow discs or cups usually with raised center. Slow growing and a good sized patch may represent growth of many years or even decades.	Reproduction is effected by continued growth of the basic fungus tissue or by the freeing of spores from the reproductive areas. In some, the spores may be carried by insects, while in others they may be wind borne. The fungi establish a medium on which and with which the algae may grow. Both may be initially wind borne.	Spores from ruptured blisters or galls spread most commonly in dry weather of late spring and early summer, germinate in presence of moisture between 46 and 97°F. These spores germinate and penetrate host tissue. On this develop sporidia of two different types, which unite and develop tissues that eventually cause the blisters.	Two years of life cycle may be spent on cedar, beginning with spores blown from apple to cedar between July and April. Small brown galls appear during summer and reach maturity following spring as galls to 2 inches in diameter. Following warm rains, jelly tendrils develop, which eventually dry, leaving galls that expel spores that infect apple leaves.
When knotty area surrounds twig or branch, it kills the cut-off area. Partial development may reduce quality and quantity of fruit produced. Many times black knot disease will kill an infected tree within a year of two. Probably infection is only through injured tissues of new host so such injury should be avoided as control measure.	Important role is played in anchoring soil, in creating soil through breaking down of rock, in delaying flow off of water because of absorption by the lichen. Will often grow profusely in areas that will not support other plants and thus assist in supporting plant-eating animals in difficult regions.	All lichens may probably be useful in providing ground cover for bare soil and rock and some have been represented as examples of inorganic material turning into organic material. For the most part, they thrive in more arctic conditions than stimulate the best growth of the associated flowering plants.	Hail damage, mechanical injury cause by topping plants, wind injury may break tissue and permit entrance of smut tissue and spores. Even failure of pollination may stimulate development of small, high, susceptible ear shoots. Seed treatment is not so effective as has been believed and rotation and sanitation are not too effective in real corn land.	Live spores going from cedar to apple have been collected at heights of 1/2 mile. These spores, reaching an apple leaf that is wet and between 56 and 61°F., may infect apple host tissue in 1 to 3 hours. Infection is not usually effected at below 47° or above 85°F. Spores from apple to cedar are freed in July and August and carried to cedar by wind.
Control is largely by pruning out of infected areas before January, when spores are freed, burning the diseased parts to prevent the freeing of spores and using sprays of Bordeaux mixture applied in March, often for other purposes. This spray may not prevent infection but it may reduce it.	<i>Parmelia</i> is suggested as a starvation diet for lost persons and possibly may be used as absorbent of animal juices in cooking to vary diet. The related reindeer moss of the Arctic provides a basis for food for reindeer, lemmings and other animals that form the base of the food chain for animals living in such an area, and for the economy of that area, furbearers included.	Probably <i>Cladonia rangiferi</i> is the most important of all plants in the areas where it grows best, forming the basis of the food chain for most animals found where it prospers. <i>C. cristatella</i> is popular because of its beauty in indoor gardens like small terrariums. It requires little attention and is usually found with ease on the ground or on old logs.	Most effective control is use of resistant hybrids, which unfortunately may be resistant in one area and not in another. However, knowledge of inheritance and use of established breeding methods offer the greatest source of hope for control. Sometimes corn smut may destroy to 2/3 of a crop but usually up to 6% is considered rather high.	Long established practice called for elimination of red cedars from regions where apple culture was important. Virginia, Arkansas, Kansas, Nebraska, West Virginia, Pennsylvania, New York and Missouri had laws encouraging cedar destruction. Lime-sulfur sprays and Bordeaux mixture and ferbam have been used effectively as control measures.



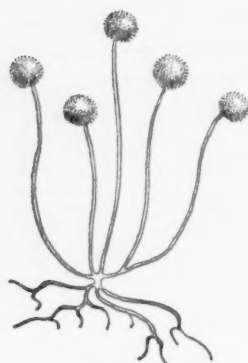
COMMON NAME SCIENTIFIC NAME	STEREUM, SILVER-LEAF DISEASE <i>Stereum</i> sp.	WHITE BUTT-ROT <i>Fomes applanatus</i>	DAEDALEA <i>Daedalea quercina</i>	INKY-CAP MUSHROOM <i>Coprinus micaceus</i>
DESCRIPTION	Stereum fruit bodies appear as woody or leathery shelves extending horizontally from the trunks of trees, with the upper surface marked eccentrically and the lower surface smooth and even and not marked by crowded pores as in so many similar structures. Upper surfaces vary in color in different species.	Evidenced usually by presence of horizontal shelves extending from trunks of trees, living or dead. In this species, lower surface is more nearly flat and level while upper surface is sloping and usually marked by eccentric growth rings. Shelves may be 2 feet or more across and in section show layers indicating new growth at intervals.	Coarse shelves found on the trunks of standing or of fallen trees. Upper surface may be flat or sloping, depending on species and with usually obscure growth rings showing. Under-surface marked by coarse pores or almost gills, forming a labyrinth, but the size and shape varying with the age of the fruiting body.	Common in dense, crowded clusters on old stumps or where trees formerly grew. The fruiting bodies bear egg-shaped caps borne in frequently curved stems and the gills are crowded closely and at maturity dissolve into inky drops, which eventually consume the whole cap. The under surface of the crowded gills may have appearance of mica.
RANGE AND RELATIONSHIP	Class Basidiomycetes. Order Hymeniales. Family Thelphoraceae. Probably most conspicuous differences lie in color of upper surface of the fruiting shelves. In <i>S. versicolor</i> , illustrated, the eccentric rings indicate varying rapidity of growth and may be associated with annual development. In <i>S. purpureum</i> , color is more uniform.	Class Basidiomycetes. Order Hymeniales. Family Polyporaceae. A member of a large group of disease-causing fungi that affect the wood of many trees. Has wide geographic distribution and wide range of host species, but mostly of broad-leaved species of trees. Other species may affect cone-bearing trees.	Class Basidiomycetes. Order Hymeniales. Family Polyporaceae. This is sometimes called labyrinth fungus because of the nature of the pores on the under side of the fruiting bodies. In some species, the fruiting bodies are thick, coarse, stiff and hard, while in others they may be relatively thin and sometimes soft and flexible.	Class Basidiomycetes. Order Hymeniales. Family Agaricaceae. The family includes the ordinary commercial mushroom and the poisonous toadstools, some of which were included in the 35th special insert of this series published in 1945. The shaggymane mushroom described in that unit belongs to the same genus as the inky-cap.
REPRODUCTION	Fruiting shelves free spores from lower surface. These are carried usually by wind to a new host where, if they fall on injured tissue, they may germinate and start development in the wood of the host. This development may be slow or rapid but eventually the host may be killed. Shelves develop when infection is well advanced, of course.	Under-surface of fruit body is a crowded mass of fine pores and tubes, which produce fine spores that are freed into the air and carried to new prospective hosts by the wind. These tubes are vertical and if tree falls the fruiting surface may form new shelves at right angles to the first. Shelves may feel rubbery at margins or in regions of active growth.	Reproduction is by spores freed from the irregular pores opening on the under sides of the fruiting body. These are carried by the wind to a suitable host and begin development if they come in contact with a wounded area that is free of the normal protective tissue. This species does not, however, attack living trees and is not a disease species.	Spores possibly may be carried by insects, or by water, but probably not by wind directly from the caps since they are in a liquid. The main plant tissue lives on dead plant tissue in stumps or in buried tree roots and may lie dormant much of the year, and possibly for some years, but once started persists until food is exhausted.
ECOLOGY	In <i>S. versicolor</i> , the shelves may be crowded to form a mass of shelves. In <i>S. purpureum</i> , the host plant, commonly cherry, apple, peach, plum, apricot or current, may develop silvery leaves that may be taken as evidence of presence of disease. This gives the name silver-leaf disease.	Probably only known cure is destruction of trees serving as sources of infection, and, of course, of destruction of fruiting bodies that produce the infecting spores over a number of years. At least a dozen species recognized as serious pests of valuable woody plants, many of them being specific as to their hosts.	Oak stumps often are covered with the fruiting bodies of this species, with the plant body consuming the tissue of the old stump. Since this species is a saprophyte living on oak, it may be useful at times in helping determine the probable genus to which the stump belonged when it was a healthy tree.	The stems of this mushroom are smooth and sometimes brittle. The caps are to 3 inches long, turning from yellow to brown to gray and finally to black. The spores have been used in inks as identifying structures. Their great abundance makes them popular with collectors who use the caps as food, either raw or cooked.
ECONOMY	Control can probably best be effected by destruction of plants harboring the disease and certainly by destruction of fruiting bodies. However, one must recognize the role of this sort of parasite in destroying weak and dead trees and removing them from competition with healthy plants. Forest trees, shade trees and fruiting shrubs are all affected by wood-rot.	Common names of diseases or related species include white-rot, heart-rot, soft-rot, sapwood-rot of trees such as birch, maple, oak, beech and poplar as well as a number of orchard species. Under-surface of fruiting shelves, when fresh, is popularly used for drawing pictures or for writing messages, using a stick as a marker.	The role of the fungus is, of course, that of destroying dead wood to make room for new individuals. Without this service, forests might well be so thoroughly cluttered that new forest growth could not have space in which to grow. As shown in illustration, fruiting bodies are unusually thick close to the host.	Inky-cap mushrooms are delicious when cooked by a short parboiling in salt water followed by a quick fry in butter. Spread on a soft, well-buttered toast they make a meal worth talking about. There are no close relatives that are poisonous so once identified they may be eaten with considerable confidence.



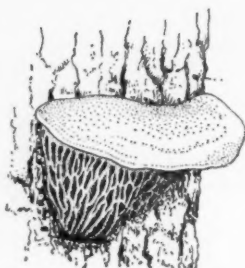
SCHIZOPHYLLUM <i>Schizophyllum alneum</i>	STINK-HORN FUNGUS <i>Dictyophora duplicata</i>	BIRD'S-NEST FUNGUS <i>Crucibulum vulgare</i>	EARTH STAR <i>Geaster sp.</i>	COMMON SCLERODERMA <i>Scleroderma sp.</i>
Thin, scalloped, dry, corky, fan-like shelves with wavy margins and radiating lines on surfaces, appear to be double, with downy surface, to 1½-inch across, shrivelling when dry and expanding when moist, stemless, and often crowded on supporting branch or wood. Split edges of gill curve around the sides.	A beautiful fruiting body but about as foul-smelling as any plant could be. The cylindrical stem, which arises from a cup at the base, may be to 9 inches long and to 2 inches in diameter and bears at the top an enlarged, coarsely pitted cap from which hangs an open lacework that supports a relatively free ring.	Appears like a small bird's nest about 1/3-inch across. At first is covered by a thin membrane, which breaks to disclose what seem to be "eggs." The "nest" is shallow and round and yellowish and a number may be found growing relatively close together. It is conspicuous enough to attract attention rather commonly.	Looks like a dark papery sphere that is flattened and with a hole on the top and covered with tubercle-like spots, the whole supported by a series of overlapping structures resembling remotely the petals of some flowers but giving the general effect of a star on the earth.	Look like hard-skinned, scabby, spherical or egg-shaped puffballs. Color of exterior varies with species and with age of fruiting body, colors involved being yellow-brown, orange, dark brown and to almost black. There is a stout stem reaching to branching "roots."
Class Basidiomycetes. Order Hymeniales. Family Agaricaceae. A stemless gill fungus. Widely distributed through the world and may be found at almost any time of the year on twigs, wood and branches of dead trees particularly of maple, hickory and other hardwoods. The fruiting shelves may be most attractive when completely spread after a rain.	Class Basidiomycetes. Order Phallales. Family Phallaceae. The fruiting body closely resembles that of <i>Mutinus</i> , which lacks the veil and swollen tip of <i>Dictyophora</i> and appears to have grown from a small egg close to the ground. The name <i>Dictyophora</i> means "net-bearer," and of course, refers to the net borne at the tip of the fruiting body.	Class Basidiomycetes. Order Nidulariales. Family Nidulariaceae. The closely related family Sphaerobolaceae is represented by plants whose fruiting bodies rupture to disclose a single "egg" not a number, as in the Nidulariaceae. The group has a wide distribution over the world but is relatively local in abundance.	Class Basidiomycetes. Order Lycoperdales. Family Lycoperdaceae. The best known relatives of the earth-stars are the puff-balls all being generally classified as members of the Family Lycoperdaceae. Earth stars are found widely distributed and may be found in one form or another at almost any time of the year although summer is the best.	Class Basidiomycetes. Order Lycoperdales. Family Lycoperdaceae. <i>Scleroderma</i> as name implies has tough, rough outer wall of spore case. When compared with the walls of <i>Scleroderma</i> fruiting bodies look warted while those of <i>Lycoperdon</i> appear to be more smooth usually.
Illustration shows under side of shelves with the gill not running continuously from center to margin of the shelf. Spores are shed from gills and carried by wind to new host. Gills are white and wooly, deeply split and curved backward along margins. They are also tough and durable in various kinds of weather.	A saprophyte that lives on decaying plant material and is rather commonly found in open fields, on sawdust piles and similar sites. Odor probably attracts insects which may figure in transfer of spores to new site for growth of the plant body. The species appears in its fruiting stage in late summer and in autumn.	Main plant body is colored, abundant, rigid, and forms a net through the host plant material. Fruiting bodies develop first as small spheres, then elongate to deep or shallow cups that are covered. Eventually, the cover disappears to show egg-shaped units attached by elastic cords to cup bases. These spore cases open to free egg-shaped pairs of spores.	Spores from the ball-like "fruit" are borne by the wind to a new site. They develop in decaying plant material and eventually form the fruit bodies which develop into the "stars." The "petal-like" parts of the stars may move up and down like springs, raising and lowering the spore box, with the changes caused largely by humidity variation.	Found growing for the most part on poor soil such as in exhausted pastures and wasted meadows. Spore cases rarely exceed 3 inches in diameter and show a firm greenish-yellow interior when broken, at least while young. Usually the outer surface is yellow brown or dark brown.
Shelves that are collected dry may be made to respond relatively quickly if sunk in water for a short time. Their appearance may change radically with a good soaking for a few hours. Shelves are too woody and tough to be edible and under microscope spores may appear to be gray, brown or even purple or white.	While this species seems to represent the ultimate in foul-smelling substances, one of the most vile smelling of all plants <i>Ithyphallus impudicus</i> also belongs to the family. The fruiting bodies are rather famous for the speed with which they develop once growth has started. They are not, however, long-lived and quickly lose what little stability they have.	The fungus is a saprophyte living on decaying plant material and is often abundant on old fences, wooden bridges, sticks and unused wood sometimes covering a considerable area with the "nests." The same site may yield the fungus over a long period of time. "Eggs" may lie free in nest at maturity when cords disintegrate.	Plants are found on ground rather than on wood but they may be in woodlands or in open meadows, in the shade or in relatively bright localities. There is probably some association with raising and lowering of spore case and suitable weather for spore distribution.	Fruiting bodies of <i>Scleroderma</i> appear from August through November usually but not always following a wet period. They may persist for some time. Two of the more common species are <i>S. vulgare</i> and <i>S. verrucosum</i> with the latter characterized by the presence of the coarse warts on the surface of the fruiting body.
Serves the role of a saprophyte useful in destroying trash of dead woody plants. The species has been known as <i>S. commune</i> . There seems to be no suggestion that it is poisonous, but it would be hard on the teeth of anyone who might elect to eat it.	Plant is probably of no economic importance either in itself or in its relationship with other living things, even though there must be an understandable tie-up between the dead plant food organisms, the saprophyte and the insects, which may be involved in spore distribution.	This fungus has but little economic importance, either negatively or positively but of considerable interest to botanists, who recognize the rather unusual reproductive story. Herbalists include reference to a "bird's nest plant" used medicinally but this does not refer to our fungus but to Indian-pipe.	There is apparently no economic importance in the plant but there is a good interest in the behavior of the fruiting bodies. They may be kept in terrariums and be made to change position by changing the humidity. There does not seem to have been any medical use but related puff balls are reputed to help stop bleeding wounds.	While it is doubtful if the fruiting bodies of this plant are poisonous it is certain that they do not make the delicious dish found when using the fruiting bodies of many of the puffballs in the genera <i>Lycoperdon</i> and <i>Calvatia</i> . <i>Scleroderma</i> just does not look good to eat and may have a discouragingly unpleasant odor as well.



Common  
Sclerotinia



Bread Mold



Daedalea

(Continued from page 251)  
ten in Denmark." To me the words suggested above as appropriate for fungi carry with them such colorful and implied meanings that I am surprised that they do not appear more frequently in standard literature.

In man's understanding of the role of fungi, able contributions have been made by the intelligent untrained observer. Good old practical farmers recognized that there was a relationship between the presence of wheat rust and barberry, between blister rust of white pine and wild currant, between red cedar and apple scab. It was long known that there was an association between the scab on an apple leaf and jelly-like substance that appeared on the twigs of red cedar. It was found that if the red cedar was removed the scab either diminished or vanished. It was not until as late as 1933, however, that the sexual phase of the disease as it appeared on the leaf was understood. When I was teaching botany in Iowa, I remember telling my students that such a relationship was suspected but not known conclusively.

It will pay you this summer to observe closely the fungal pests of the plants of your neighborhood. If a powdery mildew appears on your lilac leaves, does it affect all of the leaves at once? Are those in the shade or those in the sun most seriously affected? Watch an individual leaf closely at intervals during the day and note whether the mildew patch seems to spread more rapidly during the night or during the day.

There will be plenty of dusts and sprays offered for sale by your local dealers in such things. Do these seem to be selective, or if one is effective at one time is it equally useful at another? If you get interested in a relatively unimportant fungus that grows on your plants try trans-

ferring the infection from one plant to another. Can such transfer be effected more satisfactorily if the surface of the leaf is dry or if it is wet? Do you feel that you can suggest under what weather conditions a given fungal plant disease may become epidemic, using if possible your own observations as a basis for your conclusions?

If you have the opportunity, write to your State agricultural college for a list of the bulletins they have for free distribution about plant diseases common in your area. Procure a few of these and read at least one with care to get some appreciation of the interest your State has in understanding and in mastering the fungal organisms that cause such diseases.

You might like to consider whether, locally, if a disease occurs on one crop in a field, is it also found in equal abundance where the same crop is grown in your neighborhood? If you observe differences, you might like to try to find out why these differences exist.

Undoubtedly there will be local superstitions regarding some of these diseases, and regarding the growth of fungi in general. Try to get some idea of how seriously these may be taken by your neighbors, and whether they in any way affect local affairs.

Of course, to many of us, the role of fungi in connection with the diseases of plants is of minor importance when compared with their relationship to diseases of animals—particularly those of man. We have suggested that, in this insert, at least, we were not concerned with the bacteria associated prominently with diseases of humans. However, the molds that are true fungi also may cause serious diseases, or may play an important part in preventing the development of disease-causing bacteria. Perhaps it may be just as important to prevent a disease as to know what organism caused it. It is here that Fleming and his penicillin come into the picture, and that picture was developed rapidly under the stimulus of war and of surprisingly encouraging scientific victories that robbed war of some of its most destructive aspects.

One of the most challenging aspects of these stories of fighting diseases by means of fungi is the frequency with which the researchers have used defeat to their own advantage. If they seek to make an organism do a certain thing, they may stumble on an organism that prevents them from doing what they wanted to. Often it is most valuable to use this opposing influence to effect a certain purpose that may prove to be even more important than the one originally involved.

Fermentation is a phenomenon of major importance in industry, in the household, and in many other areas. Though knowing how to encourage and how to stop it at will, we have learned how to make foods more nutritious and more appetizing. These are but a few of the aspects of fungi that many of us fail to recognize, but which affect us all.



# Butterflies

## in the Rain

By H. H. PITTMAN

*Photograph by the Author*

"...I happened to look up, and I noticed that two white admiral butterflies had taken shelter under...the same bush."



ALTHOUGH THEY appear so fairy-like and fragile, the wings of butterflies can withstand a surprising amount of abuse, and often retain their beauty and usefulness after storms that seem severe enough to destroy them. Just the same, most butterflies seek shelter when rain approaches, either by sinking down among dense undergrowth or getting on the lee side of trees and bushes. The odd insects found in exposed places—or even laboriously fluttering in the rain—seem to be examples of what may be a reluctance to leave a particularly attractive feeding-place, although it may be heresy even to suggest linking greediness with beauty. Occasionally some of the strong-winged butterflies like the mourning cloaks will enter holes and natural cavities, or even buildings, but this may be partly due to changes of temperature as well as the absence of sunshine.

An outstanding example of indifference to rain is provided by the gallant little blue butterflies that are so plentiful on the western prairie. They often may be found in quite exposed places after a storm, clinging to the grass stems, as independent and insouciant as though nothing had happened. Oddly enough, they are frequently upside down as though they had settled on the tips of the stems, and had started walking down when overtaken by the rain.

One hot summer day on a prairie trail in Saskatchewan, a thunderstorm forced me to take shelter under a willow bush beside a little slough. I had noticed a

black cloud approaching, but did not pay much attention because it was small and seemed likely to pass to one side. The rain poured down heavily, but in ten or fifteen minutes ceased as suddenly as it started, and the sun shone again. Rain in summer can be quite pleasant, especially on the great plains where the vegetation burns so readily, but no one likes getting wet and I was glad when it was over.

While gathering my photographic apparatus together I happened to look up, and I noticed that two white admiral butterflies had taken shelter under—or rather in—the same bush. They were clinging to the under sides of leaves just over my head, and had apparently been there throughout the storm. Hanging upside down under the leaves, they had been well protected and already were becoming restless and eager to get out in the warm sunshine again. I was just able to set up a stand camera and take two pictures before the insects took flight into a wet but rapidly drying world. I had suspected that butterflies might hide in thick bushes, but to find them using the leaves as umbrellas was a new and amusing experience.

Of course, the closed wings of butterflies present very small targets, and have resilience enough to withstand the impact of ordinary rain. The occasional damaged specimens found after a storm are possibly the results of the direct hits of large rain-drops followed by further beating after the insects were "grounded." ♡ ♡ ♡

### MY POISON IVY'S PRETTY

*It decorates my acres  
With glossy growth, and dense.  
Wish we'd met before it armed  
So grimly for defense.*

Lucretia Penny





The auroch, or European bison, is a mammal that has been on the verge of extinction. In the U.S.S.R., however, an effort is being made to restore and protect this great mammal, and today there are more than 200 aurochs on Soviet reservations. Illustrated is part of a herd in the Prioksky-Terrasny Preserve.

## Conservation in the U.S.S.R.

By P. BELSKY

**I**N USING the expression "conservation of Nature," we are referring, of course, to the system of protective measures for the preservation of natural objects of scientific, cultural or esthetic value. In its wider sense, the word embraces various activities of the State for the rational use of the benefits of Nature in the interests of the people. In the U.S.S.R., the organization and implementation of practical nature protection measures are carried out by various government organizations—ministries and departments—and republican and local organs of power.

The coordination of the activities of these organs with research work is effected by the Interdepartmental Commission for the Conservation of Nature under the U.S.S.R. Academy of Sciences' department of biology. The Commission works out scientific principles for the preservation and reproduction of natural wealth, and prepares recommendations for Nature protection measures.

The Commission collects information on the distribution, the practical and scientific importance of rare and disappearing species of plants, and on areas requiring special protection measures. For example, when the wildlife population decreased markedly in some parts of the country, the Commission carried out a study

of waterfowl in their winter nesting places. With the help of aircraft, stock was taken of birds wintering in Soviet waters along the shores of the Black and Azov Seas. Concurrently, observations were carried out in the Azov-Sivash and Black Sea reservations, and in several estuaries. The Nature Conservation Commission of the Ukrainian Academy of Sciences also took part in this work.

At the same time, the commission proceeded to expand research work on animal migration. Before this, work was carried out by the U.S.S.R. Ministry of Agriculture, and was limited mainly to the study of bird migration by ringing. Subsequently, the Commission set up a council on bird and mammalian migration that included specialists in the various fields under investigation.

The Commission collected and generalized a great deal of factual data on the condition of the country's forest and fish resources, reserves of game, contamination of reservoirs and the air, and related problems. Great attention is being paid to conservation of Nature in reservations.

Until recently, the network of reservations did not correspond sufficiently to the diversity of the Soviet Union's natural resources. The Commission for the



Conservation of Nature has drawn up a plan for the development of reservations covering all geographic zones and their natural objects of value. Under this plan, work on which has already begun, it is expected that, within fifteen to twenty years, the number of reservations in the U.S.S.R. will have been brought to 116, with a total area of some 39,536,000 acres.

The Nature Conservation Commissions of Georgia, Latvia, Estonia and the Ukraine have drafted Nature conservation bills for their respective republics. On the basis of these proposals the government of the Georgian Soviet Socialist Republic passed a decision to organize eight new reservations totaling a little more than 77,000 acres. The government of the Latvian Republic has approved the organization of four reservations covering 138,814 acres, and also passed a decision regarding the protection of individual vegetable and animal species, trees, and geological formations. In the Estonian Soviet Socialist Republic, a law on nature conservation was adopted providing for the organization of four reservations with an area of 153,486 acres, while some rare species of animals and plants, parks, and several reservoirs were taken under special protection. Four new reservations covering 2,555,000 acres were organized in the Russian Federation.

At present there are fifty-six reservations in the Soviet Union with a total area of nearly 6,600,000 acres. The reservations include great tracts of forests, and flora and fauna of considerable value. They have become virtual museums of many species of plants and animals. The rapid growth of wildlife population in the reserva-



Caucasian deer are to be seen in the Teberda State Preserve of the northern Caucasus.



Dombai Glade, in the Teberda State Preserve, presents an alpine view to the visitor.

tions confirms the effectiveness of protective measures.

In the Caucasian refuge, 280 deer and several hundred Severtsov turs—Caucasian wild goats—were counted in 1924. Today, there are more than 3000 of the first and 7000 of the latter. In the Crimean reservation there were 160 deer, 220 roes and nine moufflons—wild sheep with large, curving horns—in 1922; while today the corresponding figures are more than 2700, 1000 and 250.

In 1935, only 170 saibles were accounted for in the Barguzin reservation. Subsequently, animal-breeding nurseries were organized in Siberia where many valuable varieties were raised. At present several tens of thousands of saibles are bagged annually in the Buryat Autonomous Republic where the reservation is located, and in the neighbouring Krasnoyarsk Territory. The auroch, or European bison, herd of the Caucasian reservation has been restored. Today there are more than 200 aurochs

A herd of antelope grazes in the Askania-Nova Preserve of the Ukrainian Soviet Socialist Republic.



for May, 1959



The strange "pillar cliffs" of the Yenisei taiga are shown above in the Stolby Preserve. The taiga is the great coniferous forest region that begins where the tundra of the northern U.S.S.R. ends. At the left, Z. Gutnikova, a scientific worker at the Far Eastern Branch of the U.S.S.R. Academy of Sciences, examines a wild ginseng plant.

—mammals once near extinction—in Soviet reservations.

In order to create better conditions for ungulate mammals, various biotechnical measures are conducted. Hay and twigs are stored for fodder during severe winters, artificial salines and shelters for calves are provided. In places where there are boars, topinambou—the Jerusalem artichoke—is sown. In refuges located in the deserts artificial reservoirs are made, wells sunk, and the natural water sources kept in order. In the Voronezh beaver refuge in the Usmanka River basin extensive work is being conducted to restore the willow and poplar woods. During big spring floods special rafts are built where the beavers and desmans find shelter. Nests, tree hollows and boxes are provided for insect-eating birds.

Considerable research work of a biological and geographical nature is being conducted at the reservations. Thus, in the Sikhote-Alin reservation, descriptions of shrub-like varieties of birch, yew and highland abies were made for the first time. Two new species of moss have been discovered. Of special interest is the *Pylaisia intricata* variety, which until now has been known to exist only in the United States.

Considerable achievements have been made on the reservations in fauna studies, especially in the ecology of mammals and birds. This research has created a scientific basis for the rational utilization of wildlife,

and has determined the geographic distribution, feeding conditions, ailments, and other characteristics of various animals. The results of work carried out at reservations is reflected in the printed reports of the investigators, in monographs and other publications.

The public of the country takes an active part in the diffusion of natural science and conservation of natural wealth. In 1957, the first Transcaucasian conference for the conservation of Nature was held in Baku, with the wide participation of scientific, public and administrative organizations. It discussed problems of Nature protection in the Caucasus, organizational forms of the conservation service, questions of forest and water preservation, and the work of existing and newly organized reservations in the Caucasus.

In 1958, an All-Union conference on reservations was called in Moscow by the Moscow Society of Natural Science, the Moscow branch of the U.S.S.R. Geographic Society, and the Scientists' Club of the U.S.S.R. Academy of Sciences. Some 400 people, representing 159 various scientific, public and state organizations, took part in the conference. Nineteen reports on conservation of Nature and the work of reservations were made at the conference, and decisions were adopted for the further development and improvement of Nature conservation in the U.S.S.R.



## APACHE

*At sunset  
The distant foothill  
Stands with sunburnt shoulders  
Like an Apache chief of old guarding  
The desert.*

William Allen Ward

*Playing nursemaid to baby "stripers"  
is a part of*

## Life in a Fish Nursery

By ALICE JANE MANSUETI

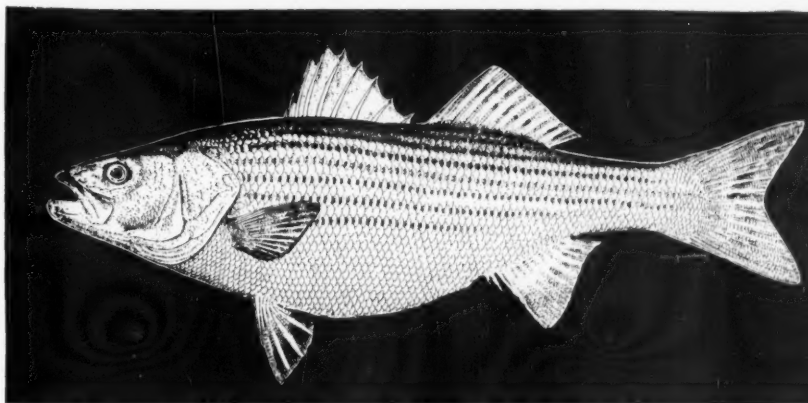
"**W**E can't come. We've got to stand a twenty-four-hour watch over some baby rockfish!" I told my mother when she telephoned from Massachusetts about our vacation trip. Needless to say, my mother was somewhat irritated to hear that my husband and I preferred spending the week end playing nursemaids to thousands of tiny fish larvae rather than lounging on the sands of Cape Cod. She commented dryly, "You certainly have changed from that lazy daughter that sopped up sun on the beach at every opportunity! By the way, what are rockfish?"

When I told her that rockfish were identical with the famed striped bass for which my brothers angled in the rivers and bays of Massachusetts, she warmed up to the subject. I remarked that when I became a southern Marylander by marriage, I constantly heard the words "rock" and "rockfish" on all sides. I admitted that some weeks had passed before I discovered that rockfish were the same fish as the striped bass I knew so well in New England waters. What is most important, this species of fish currently occupies the spotlights of politicians, fishermen and scientists.

The striped bass is one of the most important sport and commercial fishes found along the tidal waters of the Atlantic coast. It ranges from Canada to Florida, and also is found in the Gulf of Mexico. All along its range, there are "races" or sub-populations that may mix with one another during their large-scale migrations, but apparently not during their spawning runs. Interestingly, in 1879 the striped bass was introduced on the Pacific coast, and now supports a flourishing sport fishery. It is so important in the Chesapeake Bay area, where it is generally quite abundant, that it early appeared on the State seal of Maryland. Throughout its range it is highly prized by anglers and netters, who follow the changes in catches each year with great interest. In terms of vacillating numbers, the striped bass has few peers.

When the year-to-year catch is charted, one can see

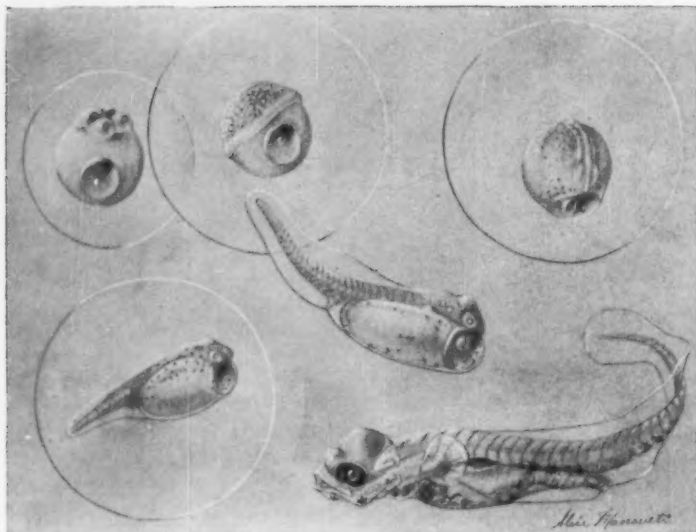
that the striped bass supply fluctuates like the stock market—that is, without rhyme or reason. In recent years the supply, although variable, has been generally high in middle-Atlantic coastal waters. Extraordinarily large numbers of fish survive during certain years; a phenomenon which, scientists say, is due to unknown factors acting favorably after the fish spawn. Sometimes failure in spawning produces the opposite condition. Such unpredictable features, therefore, are a problem of serious concern because they may mean loss of money, pleasure and time to fishermen. The principal question that confronts the fishery scientist today is



The adult striped bass is quite unlike the larval and newly transformed stages. This illustration shows a large adult female, distended with ripening eggs, called "cow rock" by commercial fishermen. The drawing, made more than 75 years ago by H. L. Todd of the old U. S. Fish Commission, is the most famous ever made of the species, although it is not typical of average body shape. Most stripers are slenderer than the specimen pictured by Mr. Todd.

whether these fluctuations are man-made or natural.

Scientists now have come to realize that Nature is possibly the principal culprit, rather than man, in bringing about the great oscillations in supply. Studies with other species of fish indicate that the ups and downs in survival can be traced to the effects of environment on eggs and larval stages. In order to try to answer some of the questions posed by the early life history of this fish, my husband and his co-workers attacked the problem with a laboratory study of early development—a phase that is little known. But first, methods of rearing the



Pictured are the eggs and early larvae of the striped bass. The larva in the center of the picture, and 5000 similar fry, all three days old, were shipped successfully by mail from a North Carolina fish hatchery to the Chesapeake Biological Laboratory at Solomons, Maryland, where they eventually were reared, in much fewer numbers, to fingerling size. When the yolk that provides nourishment during early stages is absorbed (as in largest larva in picture) the fry should begin to feed. In the laboratory they usually are unable to do so; hence they die quickly.

*Illustrations by the Author, unless otherwise credited, by courtesy of the Chesapeake Biological Laboratory.*

larval stages through metamorphosis had to be worked out.

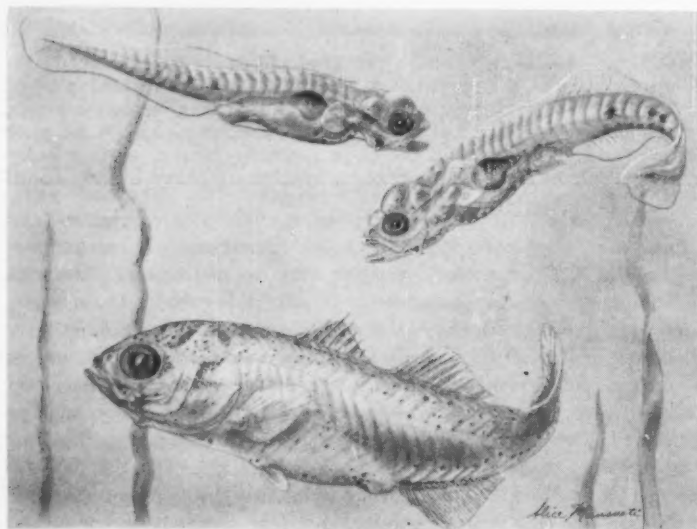
In spite of a number of attempts, no one had ever succeeded, for example, in rearing the young fry—the popular name for fish larvae—to fingerling size in the laboratory. Scientists have two questions uppermost in their minds pertaining to the early development that they want answered. What factors in Nature affect the survival of the early developmental stages and hence produce the fluctuations in abundance; and, if races or sub-populations exist, are the differences due to heredity or environment?

These questions would be partly answered in the laboratory, if rearing problems could be overcome. Also, and of more immediate value to fishery ecologists along the coast, good illustrations of all stages are needed in field work to separate successfully the striped bass from the eggs, fry and young of other species with

which it is found and with which it may be confused.

What clinched my interest in the work was that the Chesapeake Biological Laboratory in Maryland gave the study high priority, and the National Science Foundation—the Federal agency interested in many basic research projects—also provided support. With this background we began our work in a small, temporary hatchery that would have done justice to Rube Goldberg.

Our fish hatchery consisted of an array of aquaria and jars surrounded by pipes, and rubber and glass tubing. Permeating the hatchery was the perpetual murmur of aerator pumps and running water. Cultures of various kinds of live food were set up, and facilities for determining oxygen, salinity and other chemicals in the water were arranged. We even had the antibiotics penicillin and streptomycin in readiness for bacterial epidemics that might occur in our makeshift hatchery.



These striped bass larvae and small fingerlings are the hardy survivors of the mass deaths that occurred during the striped bass study. The middle and bottom stages have never been illustrated before. Study of the early stages of the striped bass was undertaken to shed light on factors affecting survival and growth, as well as to provide field workers with accurate drawings and descriptions so that the early stages of other species could be accurately separated from the eggs, larvae and young of the striped bass.



The first effort to incubate striped bass eggs taken from fish on the spawning grounds near the Laboratory ended in a failure. I stayed up all night with my husband nurturing the delicate eggs, but our facilities were inadequate and they died in twenty-four hours. Although greatly disappointed, we were eventually rescued from this dilemma.

The only striped bass hatchery now in operation in North America, at Weldon, North Carolina, came to our aid. It is specially equipped for getting the eggs through their critical stages, but it has never succeeded in rearing the fry through metamorphosis. Mr. Art Dixon, the biologist in charge, provided the brood fish, eggs and facilities. My husband, who journeyed to Weldon, participated in every chore, and then settled down to the job of watching the eggs develop and hatch in specially set-up jars.

When my husband returned empty-handed, he explained that the fry were being sent by mail, and, sure enough, the youngsters arrived in an insulated cardboard box marked "live fish." Inside the box was a large, transparent polyethylene bag filled with water and sporting myriad tiny fishes. All very much alive, they flailed their tails to simulate swimming and to remain afloat.

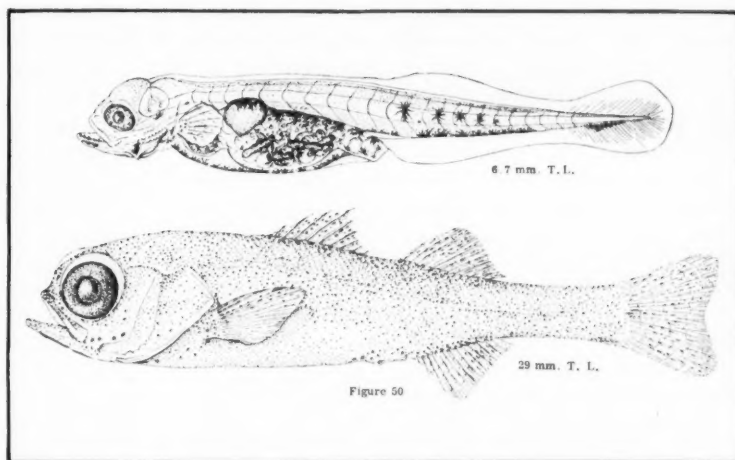
With the arrival of our precious cargo we were thrown into a frenzy of activity. The swollen bellies of the fish larvae provided nourishment for a few days in the form of yolk, much in the way that chick embryos feed. The yolks bulged out from below, and in the smallest larvae they are the dominant feature—each fry is virtually a swimming yolk with a small head and tail. With each passing day the yolk gradually diminished in size, while the head, body and tail changed in shape and appearance. At some time before this point—at about two weeks of age—mouths became functional and the fry began to feed. It is at this feeding stage that most scientists had been unable to supply the right kind and amount of food. This proved to be a big problem which, if solved, would be an important achievement.

We settled on two major foods; cultures of live, immature and adult *Daphnia*, or water fleas, and the dried eggs of brine shrimp. The latter can be bought in most pet shops, and when placed in salt water hatch in about twenty-four hours. These immature shrimp were greatly relished by the baby fish. About five days after hatching, the baby stripers began feeding on very small *Daphnia*, and a few days later they graduated to brine shrimp. We were elated at this event.

Feeding and cleaning operations were never-ending

tasks. The aquaria were policed twice daily. Dead fry, decomposing food, and predators such as hydra, whirligig beetles and other flying aquatic insects that entered the aquaria were systematically removed. Organic matter that was not pipetted could lower the oxygen in the water to a dangerous level and wipe out all inhabitants overnight by suffocation. Aerators and other equipment were checked regularly. In the morning and early evening a half pint of water from the brine shrimp culture jar was strained through filter paper in a funnel, resulting in an orange mass of several hundred brine shrimp bodies that would fill a half-teaspoon. When the shrimp were introduced into the water, the stripers would rise and rapidly engulf the fleshy crustacea as the food gradually sank. Their bellies gorged and yellow with food, the stripers would forage for an hour or so on the remaining shrimp at the bottom.

All of this activity was secondary to my main task. With pencil, pen and brush, I illustrated each stage in



"Pugnosed" features in striped bass were found in the larval and transformed stages. This is an unusual abnormality that, prior to this study, had been observed only in half-grown or adult stripers by scientists and fishermen. Unfavorable environmental conditions low in oxygen are believed to be partly responsible. In the stomach of the top larva may be seen immature stages and eggs of the brine shrimp.

the development. When I first placed three-day-old fishes under the microscope, all that could be seen were flashes of movement. When I finally did get a good look at them, they were unorthodox, as fish go, and resembled tiny tadpoles. It was hard to believe that these curiously shaped creatures could grow into the noble-looking and huge stripers that attain a weight of fifty pounds. One thing was sure; these fish were no exception to the rule that larval fish rarely look like their parents. Older larvae were no different.

If you looked at one of these week-old fish under a microscope, you would see a minuscule monster with a pair of button-black eyes, followed by a few star-like black spots and a trail of agitated water. The rest of the body of the tiny young striper was transparent.

Tragedy befell the nursery ward about two weeks after the fry hatched. Mass deaths occurred in all the aquaria. For three to five days dead and dying fishes were found, so that only about 400 of the original 5000 larvae survived. We speculated that, since these individuals had been unable to feed successfully, they had died from starvation.

Actually, we were prepared for this blow. Scientists have found that such mass deaths in the laboratory are a common occurrence among the larvae of fishes that produce large numbers of unattended young. This phenomenon has been the primary reason why the early stages of these species, and the factors that affect their survival, are little known. The loss was a shock, but it provided an added stimulus to our efforts to save the survivors.

Luckily, most of the "elite 400," as we called them, fed voraciously, although some continued to die and others had to be sacrificed for scientific reasons. During the following three months the young fish required less and less care, grew in size, and graduated to feeding on larger types of small crustaceans. At the end of this period about fifty fish survived; but they too died suddenly, probably from poisoning due to formaldehyde absorbed by aquarium water from the atmosphere. When I recall the sequence of developments that preceded this ending, I see the metamorphosis from the tadpole-like stage to the elongate, knife-blade-shaped slivers, and gradually to the small conventional fishes that preceded the end. I displayed the same wonder as I had in my childhood when I watched the magic of the change of caterpillars to butterflies, and polliwogs to frogs.

One of the interesting sidelights of the work was the discovery of larvae and young with the facial features of a pug, the dog with the "pushed-in" face. Half-grown and adult striped bass have been caught in the past with

this abnormality, and hence the term "pugnosed" fish. Several scientific publications—and even newspapers—have described this feature in the striped bass; but I was happy to find that I had apparently drawn and observed the first pugnosed larvae and fingerlings. How this anomaly is produced is unknown, but scientists believe that the likeliest cause may be unfavorable environmental conditions.

There have been few attempts at rearing the larvae of striped bass through transformation to small fingerlings. In 1937, John Pearson, presently director of the public aquarium in the Commerce Building in Washington, D. C., had succeeded partially when he raised larvae up to one-half inch long at a North Carolina hatchery. Since that time, interest in and problems concerning this species have increased to enormous proportions, thus providing impetus for further research on the early aspects of its life history.

The work in which I participated is important principally because it paves the way for greater contributions to the many problems that still exist concerning the fish. It has little application to a feasible program for restocking of fingerlings for management purposes. It is of interest to note that commercial hatcheries for restocking striped bass, which always have been few in number, are now frowned upon in principle by fishery scientists, since hatchery production usually cannot approach natural reproduction in magnitude. Many scientists believe that better knowledge of the basic biology of the species and ensuing better management of natural populations would sustain or increase the supply of striped bass better than artificial propagation.

At a family get-together not long ago my mother recalled the time when 5000 fish fry interrupted my holiday. After much laughter she remarked: "Well, you learned early that raising young, be they bass or babies, is a tough but gratifying job." I nodded my assent. ♡ ♡

## SUBURBIA

*Within its tranquil pickets our backyard  
Remembers still its day of wilderness,  
Loosens the slats to fit the peering fox  
And seeds the lily pool with native cress.*

*It frays the nursery shrubs to rabbit brush,  
Crumples the pavements with its secret root,  
Beckons its branches to the soaring hawk,  
Invites the finch to spoil the ripening fruit.*

*It sets up wayside squatters in the borders,  
Erings up a boulder where the lizards drowse,  
Trajects the sunlight with a mullein seed  
And nudges jealously our small gray house;  
Engages moonlight in complicity  
To make a forest of its one oak tree.*

Cleo Sibley Gross

# Jackpot for Rockhounds

By ROBERT B. McCOY

*Photograph by the Author*

The semi-precious gemstone known as jade is a tough and compact variety of the mineral tremolite, and is known mineralogically as nephrite. Varying in color from pure white through varying shades of green, jade is hard enough to take a fine polish, and is commonly used in the less expensive kinds of jewelry.



WYOMING jade is dense, hard and richly green, yet translucent and warm with a lambent fire deep inside. It polishes to a mirror-like finish, and when worn in contact with human flesh, it takes on a subtle, gentle glow somewhat as does a pearl. Rockhounds love its quiet, subtle beauty.

We had found some fine pieces in the Wind River jade country. In the long stretch from Lander to the Grand Tetons, the highway hugs the valley of the Wind. We had stopped dozens of times to explore the sloping sides of cactus-dotted, sagebrush-covered buttes. Always our eyes returned to the cold, roaring river that dominates the scene, and usually our feet soon followed.

The Wind is a beautiful river, itself the color of pure jade where it leaps and bounds over unseen boulders. At one eye-catching stretch of angry rapids, where many-toned green shadings betokened a rock-strewn channel, we found lumps and shards of jade. Some were so laden with flaws, faults and matrix as to be useless. But now and then, often enough to keep us rewarded, we found slabs and chunks that—when held up to look through—showed clearly that the sun was really no sun at all, but a huge, pulsing emerald in the sky. Here were real jade finds!

We were actually bound for the Tetons, but even the most rockhappy rockhounds must stop sometime. We cooked an early supper in a colorful bend of the Wind. Here the smooth water swept deep and silent beneath stately cottonwoods. On both sides of the valley reared a silent phalanx of thrusting scarlet buttes, diminishing

into the growing dark and dusk as sky met horizon.

How can words describe the glory of the Tetons in the dawn? The sky behind them is still dark with the fleeing night, making a matchless backdrop for the proud and soaring peaks. The fading stars vanish as the eternal snow catches and reflects the growing flush from the east. The soft and graceful clouds become drapes of shimmering mist, and living light marches in a steady, brightening procession down the ramparts to the plain.

And for a while one is rooted in silence before this incomparable splendor of Nature. Below, one sees the vivid, rolling miles of Jackson Hole; one's spirit soars to the warming skies in the intoxicating fragrance of the great trees all about. One hears the infinite chorus of small wildlife beginning another day. To the tongue there seems the bite of dew-wet sagebrush, and there is a soft caress in the crisp and vigorous air as it passes.

The highway drops from the eastern heights and winds across the flat Hole country to Moran. We had in mind rockhounding the Gros Ventre river bed, remembering from a previous visit many signs of nephrite. The rough stones look not unlike lumps of white sugar, ranging in size from a pebble to a boulder. Only by peering into a chipped or broken opening can one find the deep translucency inside that betokens fine jade.

We turned south at Moran, finding it difficult to pass beautiful Jenny Lake without stopping for a time. But we reached our goal about noon, and drove directly into the dry river bed from the highway. It was June, usually a time of water in the Gros Ventre; now, however, we

found it a shrunken little rivulet, pure, cold and clear as perfect crystal. We ate some hasty sandwiches, shouldered our gear, locked the car and started westward up the river bed.

The landscape as we hiked was a treeless, tortuous, fantastic jumble of rocks and slide debris. By our pedometer we had struggled nearly six erratic miles from the car when, to our left, the south end of the Teton Range began etching a chip from the bottom rim of the descending sun. Dusky blue shadows began creeping out of the west toward us.

We climbed an ascending ledge on the east side of the river-bed, and as we pulled ourselves across the crest we found we were at the edge of a tree-rimmed, good-sized moraine lake. We built a fire, ate, cleaned the equipment, then settled down to enjoy the night. Fresh wood on the glowing embers sent a flat ribbon of blue riding upward at an easy drift into the darkening sky. The brilliant point of a star appeared, and made a transient image on the restless lake. Darkness fell softly.

More stars appeared, growing brighter and more unwinking the darker became the night. Above us towered the peaks, among them soaring the faintly luminous drifts of cloud forever chained to the icy summits by some fragile force of affinity. The moon slowly rose, painting the mountains with bold strokes of black and white. The lake ruffled gently at the kissing touch of the night wind. From the distance came the desolate cry of a coyote, and like an echo dimly heard came an even more distant reply.

Then to bed, and another magic dawn. A breakfast to remember for a lifetime; then back to the course of the Gros Ventre.

Now seriously searching, we found jade in chunks, slivers and shards of nephrite matrix. Some of it was broken, showing free jade, and so abundant that we could explore in all directions. I left my companion contentedly assembling a small cairn from which later we could make a choice. I went north, excitedly clambering up the course of a small stream that emptied into the Gros Ventre bed.

Half a mile or so I stumbled, by now ignoring jade pieces that made our Wind River finds look like junk. The small creek had eaten deeply, and eventually I wound up in a boulder-strewn canyon perhaps fifteen feet deep, dark, narrow, and laced at one end by a fairy-like waterfall. I stared about in growing amazement,

until it suddenly dawned on me that I had struck a jackpot for rockhounds!

I rushed back to my companion, and we skinned shin-bones and ankles unheedingly as we clambered and scrambled back to the canyon with a flashlight. In awe we traced the thread-like veins of purest jade, looking deep into its bare, translucent heart as it widened and thickened in the wall toward the falling water.

Like a miracle, the shimmering veil was falling from a jutting, overhanging slab of the finest jade we had ever seen. Here was a mother lode of a size and purity beyond description; beyond imagination, almost! With the powerful beam of the flash, we could see into the lode nearly three faultless inches. Much of the outcrop we could see was worn and smooth, polished for a thousand years or more by the softly falling water. The deposit spread as much as four to six feet upward, and to nearly an equal width. How deep? We could not tell.

Jade is a hard stone, much too hard to chip and break easily in a spot like this. Like most rockhounds, we carried no heavy equipment, either with us or in the car. Usually a tap hammer is enough. In this case, there was really no need to molest the mother lode, anyway. All about were chunks and pieces big enough to satisfy even the most greedy.

Nevertheless, we found it difficult, indeed, to break away from the sheer magnetism—the thrill—of this rare and wonderful discovery. Asian jade is expensive; Wyoming jade, as good or even better, is yet not considered as valuable by American gemologists and jewelers. But it is fine material for rockhounds, the amateur gemologists who like to cut and polish their own jewels and gems. So our treasure, so wonderful to us, had little or no commercial value.

But we were not thinking about dollars, really. We shall return there again some time. Only rockhounds know the utter fascination of such a hidden treasure, or the strange compulsion that can draw one to it again and again.

But anyone who really loves Nature will agree, we think, that in its time and place even a simple, worthless stone is a rare and wondrous thing. In its lowly way, it is a part of the great and beautiful order of Nature. In the recollection of moments and memories like these, we are wealthier than we would be had the mother lode been pure gold instead of beautiful jade. ❀ ❀ ❀

## DEBT REPAYED

*When I was a child, May was savored,  
From a huddled house on a narrow street,  
Pallid May, city flavored,  
Stingy with grass for my eager feet.*

*Now May remembering so much lost,  
Shakes blossoms for me in a fragrant snowing,  
Lets a cardinal sing on a flowering bough,  
My cup overflowing.*

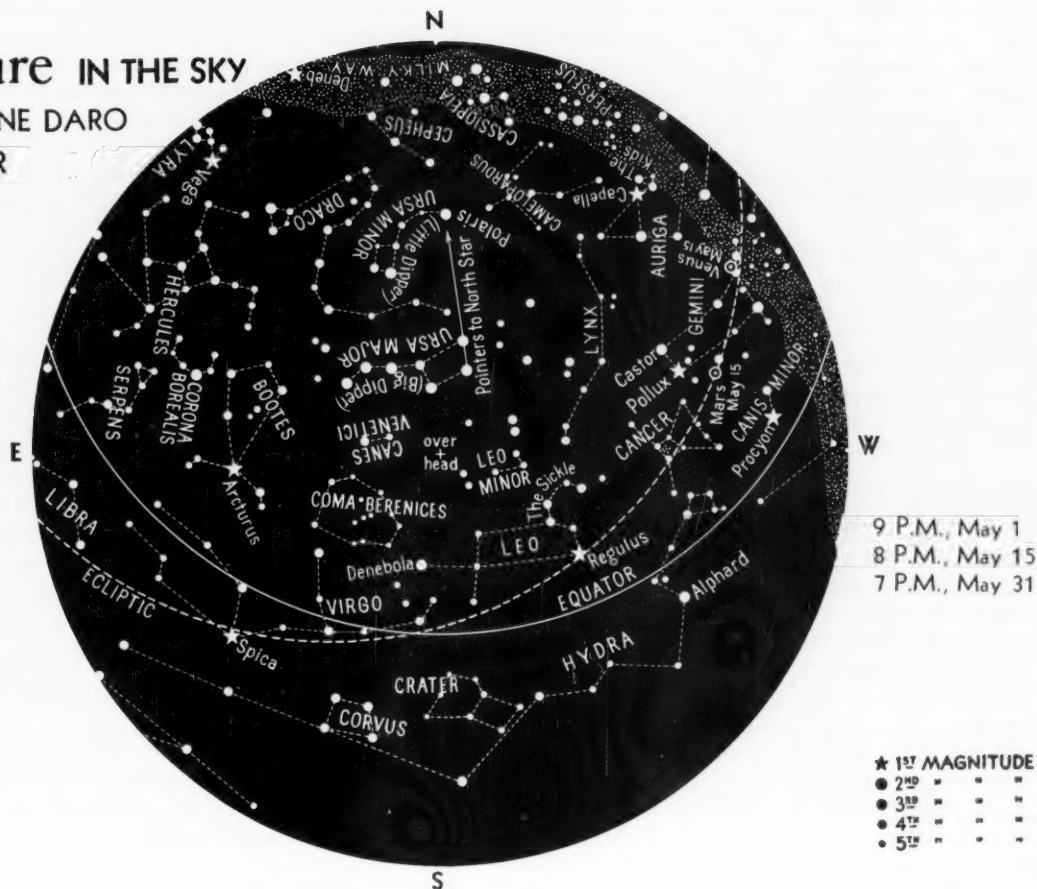
Bessie F. Collins



# Nature IN THE SKY

By SIMONE DARO

GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

## The Ionosphere

**R**ADIO is only as old as the twentieth century. It has been an integral part of our daily lives for less than four decades, although the children of today would probably find it difficult to imagine life without it. Yet radio transmission could not even exist without the presence of the ionosphere.

In 1901, Marconi sent from Cornwall a radio signal that was heard in Newfoundland. This was a most puzzling phenomenon. Radio waves were known to propagate in a straight line; how, then, could they have followed the curvature of the earth's surface? Scientists could explain this only by assuming the existence of a special layer in the atmosphere that would act like a mirror and reflect the radio waves back to earth. It is interesting to note that, although they had

guessed right, they were unable to prove it. More than twenty years elapsed before direct confirmation was obtained.

In the mid-twenties, conclusive evidence resulted from the experiments of various scientists, here and abroad. The most direct proof of the existence of a reflective layer was provided by G. Breit and M. Tuve in 1926. They placed a radio receiver a few short miles from the transmitter—close enough, that is, so the curvature of the earth would be negligible. They could thus receive a direct signal. A radio transmitter, however, sends off waves in all directions, horizontally, vertically, and obliquely. Breit and Tuve were able to show that, in addition to the direct signal, they also were receiving a second one after a brief delay. This was in-

deed the reflected signal—or echo—which had “bounced off” the atmosphere. The delay was caused by the greater distance traveled by the reflected wave, as compared to the few miles covered by the direct signal.

The ionosphere is the region of the atmosphere where this reflection takes place. It derives its name from the presence of gases that have been ionized by solar radiation. A few words on the meaning of the term “ionization” may be in order.

Atoms consist of a nucleus surrounded by a specified number of electrons. The electric charges of the electrons compensate the charge of the nucleus, so that an atom equipped with its full quota of electrons is electrically neutral. If, however, through an external cause, the atom is stripped of one or more of its electrons, the balance of electric charges is disrupted. The nucleus, with its remaining electrons, is charged positively, while the electrons that have been stripped from the atom are now free agents, each with its negative charge. The stripped atom is called an ion. It is therefore said to be ionized.

Two charges with the same name—both negative, for example—repel each other. Thus, if two free electrons encounter each other, they will promptly take off in opposite directions. As a result of this, if a large number of free electrons are present, they will all eventually travel in zig-zag fashion, and at extremely high speed. On the other hand, two electric charges with opposite names, one negative and one positive, attract each other. When they come in contact, an electric discharge takes place, giving rise to a brief glow, precisely as lightning is caused. Thus, if a free electron encounters an ion, they will recombine under the attraction of their opposite charges, and the resulting discharge also will give off a tiny glow.

In the earth's atmosphere, one of the principal causes of ionization is solar radiation. The ionosphere—that is, the region where ionization is present—extends from about forty miles up to the outer confines of the atmosphere. A certain amount of horizontal stratification is known to exist within the ionosphere. Scientists distinguish particularly what they call the D, E, and F layers.

The D layer is the lowest, extending roughly between heights of forty and sixty-five miles. Very little is known about it. Its existence is mostly inferred from its effects, rather than from direct observation. High-frequency signals tend to be absorbed below the E layer, and this is accepted as evidence that ionization exists at this lower level.

Above the D layer is found the E region, extending between heights of sixty-five and seventy-five miles. The amount of ionization in the E layer is directly influenced by solar radiation and solar activity. It is at a

maximum around noon, but becomes almost insignificant at night.

The F region is by far the largest of the three, extending between heights of ninety-five and two hundred and fifty miles. Contrary to the E layer, it remains ionized at night.

The ionized gases act as a resisting medium for the radio waves that strike them. In the case of a radio signal travelling vertically, the waves are gradually slowed up until they are stopped altogether. The signal

then begins to travel downward at increasing speed, until it regains once again the velocity of light. If the path of the signal is slanted with respect to the ionospheric layers, it becomes deflected in similar fashion.

Since the E layer exists only in the daytime, the reflection of radio signals will occur within the E layer during the daylight hours, while at night it will take place within the F region. Since the latter is located much higher than the E layer, radio signals will travel much farther at night

than they do during the day.

This is the reason why certain local radio stations are given a limited permit to transmit only in daytime, and must go off the air at sundown. If they were authorized to broadcast at night, their signals would reach a much greater area, and would thus interfere with the transmission of other distant stations.

At times of great solar activity, when, for example, a large sunspot is visible, severe disturbances will occur in the ionosphere, accompanied with abrupt changes in the transmission of radio waves. Sudden disturbances of the earth's magnetic field will similarly affect the ionosphere and wreak havoc with radio communications. The resulting disruption of signals may last for several days.

Magnetic disturbances in the ionosphere are also responsible for the occurrence of the spectacular northern lights (aurora borealis). The tiny glow of the electric discharge caused by the recombination of an ion and a free electron is multiplied millions of times to produce the bright auroral displays. Actually, there is always a certain amount of aurora present in the ionosphere, since these recombinations are always taking place. But, when all is quiet, the resulting luminosity is not noticeable to the naked eye. It is only detected by instruments, and then is called “airglow.”

In the month of May, the New Moon will occur on May 7, and the moon will be full on May 22.

Mercury will be a morning star, rising 45 minutes before the sun on May 1, half an hour before the sun on May 15, and 15 minutes before the sun on May 31. By the middle of May, and for the (Continued on next page)

## MAN AND GALAXIES

*A thousand million stars have poured  
A gust of warmth and light;  
Across space, galaxies are shored,  
Oblivious of our night.*

*Such are the giants controlled by law:  
How can there help but be  
In everyone a thought of awe  
And deep humility!*

Daniel Smythe

remainder of that month, it will be too close to the sun for observation.

Venus will be very conspicuous in the western sky for about three hours after sunset during the whole month of May. It will set in the northwest at about 9:45 p.m. on May 1, 10:30 p.m. on May 15, 10:45 p.m. on May 31. By the end of May, it will be located south of Castor and Pollux. It will brighten gradually from magnitude  $-3.6$  on May 1, to  $-3.8$  on May 31.

Mars also will pass south of Castor and Pollux during the month of May, but Mars and Venus will not be in conjunction until the following month. Mars will be in the western sky at dark, setting at about midnight on May 1, 11:30 p.m. on May 15, and 11:00 p.m. on May 31. Its magnitude will average  $+1.7$ .

Jupiter, in Libra (magnitude  $-2.1$ ), will be found to the northwest of Antares. It will rise one and one-half hours after sunset on May 1, and at sunset on May 15, remaining visible for the rest of the night. On May 31, it will have risen by dark, and will set about one-half hour before sunrise.

Saturn, in Sagittarius, (magnitude  $+0.5$ ), will rise shortly after 11:00 p.m. on May 1, 10:00 p.m. on May 15, 9:00 p.m. on May 31. It will remain visible for the rest of the night, being low in the southern sky at sunrise.

### Meteorites Acquired

The Smithsonian Institution of Washington, D. C., has recently acquired an assemblage of meteorites that came to earth in southwestern Kentucky on September 20, 1950, in Callaway County. Some 16 pounds of fragments, now at the Institution, were recovered in 1955 by Mr. Hugh Howard, a meteorite collector, who spent several months canvassing an area of 60 square miles in search of the meteorite pieces. The explosion of the stone that was the parent of these pieces shook homes and buildings from Paducah, Kentucky, southward to Memphis, Tennessee, and five buildings were struck by fragments.

### Wilderness Trips, 1959

Spring is the time of year for those mouth-watering brochures about trail trips into the nation's wilderness areas that are offered each summer by various organizations. During the coming summer the American

Forestry Association of Washington, D. C., will conduct its usual "Trail Riders of the Wilderness" program in which parties of from 20 to 25 persons each will penetrate eleven of the outstanding wilderness areas of North America in fifteen pack trips, one of which will be by canoe. Detailed information about dates, itineraries and reservations will be sent on request to the Association at 919 Seventeenth Street N. W., Washington 6, D. C.

At hand also are the alluring brochures of Joseph Wampler of Berkeley, California, conductor of the well-known "Wampler Trail Trips" into the back country of the West—places like Havasu Canyon in Arizona's Grand Canyon, the back country of Carmel in the Coast Range, the Sierra Nevada, and Old Mexico, among others. A letter to Mr. Wampler at Box 45, Berkeley 1, California, will bring detailed information concerning each trip.

### New Monument

On September second, 1958, President Eisenhower signed a bill authorizing the establishment of Grand Portage National Monument, an area of 700 acres in the Grand Portage Indian Reservation of Minnesota. The monument will protect the historic nine-mile trail around the rapids of the Pigeon River known as the "Great Carrying Place," as well as the stockade area of the old Northwest Company and the terminus of the trail, Fort Charlotte. The trail was the route over which the early voyageurs carried their goods from Lake Superior to the border canoe routes.

### Forestry Conference

The first international forestry conference ever held in the western hemisphere will bring foresters and related scientists from some 80 nations to the University of Washington in Seattle during the period of August 29 to September 10, 1960, according to Richard E. McArdle, chief of the United States Forest Service. The chief topic for discussion at this Fifth World Forestry Congress will be the better utilization of the earth's forest resources in a world increasingly crowded with people. "It is a scientific non-political conference at which participants will exchange useful technical information on a wide variety of topics," says Dr. McArdle.



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# Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University,  
and Director of Nature Education, The American Nature Association

## Funguses in School

THE SCHOOL AQUARIUM OR TERRARIUM may be used in the laboratory for some inter-

esting studies of funguses by any group of children. If a pet goldfish develops spots of white fuzz on its sides, it may be important to try to save the animal. Read the section in this month's special insert on water mold, and try what you find there on your fish. Give the fish a bath in salt water of the suggested strength and see if the trouble vanishes. Of course, you should not leave the fish in the salt bath until it faces difficulties because of the salt.

If you have planted outdoors, or in your terrarium, some seeds that you wish to be sure get a good start, try these things. Water a few of the plants rather intensively. Possibly some morning you may find that the seedlings so moistened have all wilted suddenly. This may be due to a "damping off" disease. How would you suggest, from what you see, that this could be avoided? It may be all right to water the flowers, but it is not all right to water them too much.

It may be worth while to try to protect some seedlings from a late frost by putting empty bottles over them. You will see that, when this is done, vapor may collect on the inside of the bottle, and you may find that it pays, now and then, to remove the protective bottle and give the young plant a chance to go it on its own.

### Terrarium plants

If you have some plants growing in your terrarium you probably have a glass cover over the top. Sometimes such terrariums get too humid, and under these circumstances many of the plants may die. Look some of these plants over carefully to see if there is any evidence of fungal growth at the point where the plant seemed to collapse, if it did wilt.

You might find it advantageous to try growing plants in a whole series of glass bottles. If you find some sticks that seem to be supporting

some pretty scarlet cups, or a patch of lichens like British soldiers, you might try putting a few in different bottles and then find out whether they survived in brilliant sunlight as well as they do in the shade, and whether they could equally well survive drying. If they seem to collapse, do they have equal power of recovery if the original conditions are restored?

You might find that it took much space to keep a large series of bottles as terraria, so see what you can do using smaller and smaller bottles. You may eventually come to a point where even test-tube-sized bottles are good enough to show you what you want to know about a fungus. When this time comes, you may realize that the test tubes used by plant pathologists and by bacteriologists are nothing but little terrariums so shaped that they may support the organisms the scientists are interested in studying. You can do similar work if you use, as a medium on which to grow your molds, simple fresh slices of potatoes. You may find that you do not get a clear culture with careless methods and may realize that your potato culture does better if it is cut with a thoroughly cleaned knife, if it is put in a thoroughly cleaned little test tube and if care is taken to introduce into the tube only the plants or cultures that you may wish to study. These simple procedures may give you an idea of how some scientists have learned about some of the fungal plants that live about them.

### Mushrooms in rings

The last portion of the special insert in this magazine suggested a series of areas you might wish to explore on your own. For example, suppose we might want to understand why it is that some mushrooms appear to be found in rings. There have been, and undoubtedly still are, people in your community who may believe that these rings were formed by the fairies, who used the toadstools to sit on while settling

matters of importance. Suppose you attack this situation in another way. You realize that plants and animals need food to live. Suppose, then, that a fungus started growing, and, in the process, exhausted all of the immediately available food. When it came time for it to stop growing for a while there was a central area in the soil without food and this was surrounded by an area that had an unexploited food supply. Next year this food supply was explored by the underground fungus spreading the circle of exhausted food supply. If, at the end of the season, the underground fungus sent to the surface a few fruiting bodies like toadstools these would naturally be in a circle. Next year the process would be continued and the circle would be further enlarged. Does this explanation have some logic? Or suppose you were dealing with a fungus that was feeding on the root system of a tree that has been cut down. If this started at the point where the tree was cut, how natural it would be for each year's fruit bodies to appear above the ground in an ever-widening circle.

### Interesting lichens

One of the most interesting groups of funguses to fool with is the group to which the lichens belong. Try using heat, light and moisture to see if you cannot, in little bottles or test tubes, determine the conditions that stimulate their growth. Once you have learned how to make a seemingly dead lichen freshen up and begin to grow you may have made an observation that will be useful in understanding many things taught you in your geographies about life in the north. Try putting some of these lichens in test tubes in a refrigerator for a week or so during the summer season to notice if they recover when brought back to warmer conditions. Do your other terrarium plants have equal recuperative powers? Try to see if you can really freeze a lichen so thoroughly that it does not recover at all when given the opportunity. Unfortunately the growth of lichens is so slow that you probably cannot learn much about it, but you can make lichens wilt and recover, and can see that moisture and temperature have some effect on them. Since the lichens are primarily funguses, any of these studies you may make may have some bearing on increasing your understanding of the nature of some funguses, at least. ♀ ♀ ♀



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Workshop staffs include Dr. Norman F. Kunde, assoc. prof., University of Washington, workshop director; Dr. Lynn S. Rodney, chairman, recreation and outdoor education curriculum, University of Oregon; experts in natural history, fish and wildlife, and specialists in organization camping.

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### Leadership Training

Leadership training in outdoor education, conservation, recreation, and camping will be emphasized in the graduate courses to be offered for credit during the summer of 1959 by Indiana University at Bradford Woods, near Martinsville, Indiana. The courses offered are: School camping and outdoor education, June 1-12; camping administration, school camping, social recreation, and field problems, June 13-August 7; workshop in conservation education, August 10-22. The faculty includes Reynold E. Carlson, Robert Tully, Prevo Whitaker, and visiting leaders from the university and various governmental agencies.

Bradford Woods is Indiana University's 2300-acre forest, devoted entirely to camping, outdoor education, and recreation. It is the national home of the American Camping Association. Further information may be obtained from the Resident Director, Bradford Woods, Martinsville, Indiana.

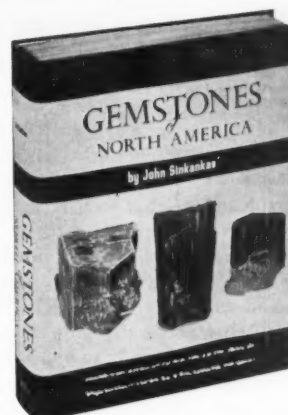
### "Sea Giant" Item

Mr. W. H. Bryan, professor of geology and mineralogy at the University of Queensland, at Brisbane, Australia, has furnished an additional fact concerning the biography of *Kronosaurus queenslandicus*, the hundred-million-year-old marine reptile whose fossil bones are on display at Harvard University's Museum of Comparative Zoology at Cambridge, Massachusetts, and whose story was related in *Nature Magazine* for January, 1959. (*A Sea Giant Goes to Harvard*). According to Professor Bryan, *Kronosaurus* was named by Mr. Heber A. Longman, F.L.S., of Australia, in the year 1924, and was described by him on the basis of a few bones found near Hughenden, Australia.

### Forestry Publication

Recently released by the U. S. Forest Service, Washington 25, D. C., is a forest conservation teaching aid entitled *Forestry Activities—A Guide for Boy Scout Leaders*. While the forest conservation activities outlined in this 32-page pamphlet are primarily addressed to Boy Scout leaders, most of them are equally applicable to schools having other youth groups, and single copies are available free to teachers and others from the Forest Service in Washington and from Service offices throughout the nation.

## Coming Next Month!



## GEMSTONES OF NORTH AMERICA

by John Sinkankas

This handsome, authoritative volume, written by the author of *Gem Cutting: A Lapidary Manual*, tells the story of the most fascinating mineral treasures in North America—GEMSTONES. It describes in careful, accurate detail, with many illustrations, each gemstone species—where and under what circumstances it is found.

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# THE Nature CAMERA

By EDNA HOFFMAN EVANS

## Insects at Short Range

SEVERAL WEEKS AGO I RECEIVED A letter that began something like this: "I am interested in close-up photography of insects in both color and black-and-white. . . Please tell me all you know about the subject and suggest sources where I can find additional information."

I have been slow in answering the letter, because I was not at all certain just how much I did know about close-up photography of insects.

My latest "go" at the subject had not been too successful. I was still feeling thwarted and frustrated, because the results that came back from the color finisher were not at all what I had hoped they would be. The shortcomings were entirely my own. Never have I had a more cooperative model.

The model, in this instance, was a two-and-a-half-inch-long green praying mantis, and a most lady-like insect she was. I found her on a rose bush in the yard, and I brought her indoors and housed her in a quart jar for several days until I could get around to photographing her. She looked cramped in the jar, so I moved her to a small Kentia palm that grows in a pot on the kitchen window sill. She stayed there quite happily for another couple of days, and never strayed any farther away than up the curtain a time or two.

### Setting the stage

Finally, after she had spent almost a week indoors, I set up a "stage" on the dinette table, arranged the lights, and tried for some close-up pictures. Mrs. Mantis was most obliging. The heat from the photofloods bothered her somewhat, and so did the glare. She preferred to hang upside down on the twig I provided for her to pose on, and she moved away from the light as much as possible. Nonetheless, her cooperation was most gratifying.

I use the Exakta with extension tubes for close-ups, and this time I used two photofloods, one on either side, for illumination. The back-

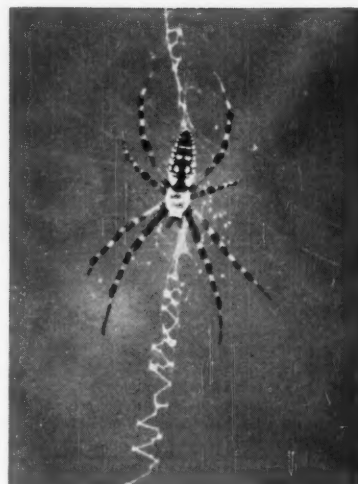
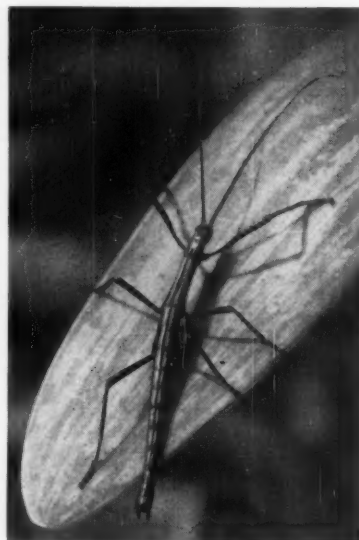
ground was a sheet of blue cardboard leaning against the wall to simulate sky in the distance. In the camera was 35mm. Kodachrome film, indoor type, which is quite slow.

With the shortest of the extension tubes, I was able to get the entire mantis into the picture. Those slides are quite good, I think. By using a tripod and taking the exposure as slowly as possible, I was able to get enough depth of field to have all the body details in focus. But those pictures lacked "oomph." They are merely mantis pictures, and what I wanted were poses that showed character.

Extreme close-ups, using the longer extension tubes, were the answer. But when I moved in close the results were far from satisfactory. The closer a lens gets to a subject, the shorter the depth of field becomes. Thus, when I had the front portion of the mantis' head in focus, anything more than a quarter of an inch back was fuzzy. And a mantis is a long, drawn-out creature.

More light would have helped the situation, because that would have

Walking-sticks are large enough so that photographing them does not require microscopic-photography techniques.



The main problem with spiders is to get enough light on the subject and to block out distracting details in the background.

allowed me to decrease the lens aperture and thereby deepen the area in focus. But Mrs. Mantis did not like the heat of the photofloods. When I moved them too close, she dropped down from her twig and scurried away. It was not comfortable for me, either, working in such close quarters. Every time I moved my head I scorched an ear on the hot metal of the reflectors. Finally, I gave up. Next morning I set the mantis free and, although she stayed in the bush in which I liberated her for several days, I did not try to photograph her again.

### Expecting too much

My experience showed me several things—and other experiences along the same line have done the same. I was expecting almost too much of my equipment. After all, there are limitations to cameras, film, and lighting.

I could have obtained greater depth of field if I had used a faster film, either black-and-white or color. There is a vast difference between a film having an exposure index of 10 or 16 and one with an index of 100 or 200—but I am a Kodachrome fan, and stubborn. If I owned an electronic flash, I might have done more about the lighting situation. I might have taken the picture from farther away and "blown up" a small portion of it in the enlarger. To do that, I would have had to be sure that my details were sharp and would stand enlarging.

So, while I did not do right by Mrs. Mantis, I am not particularly

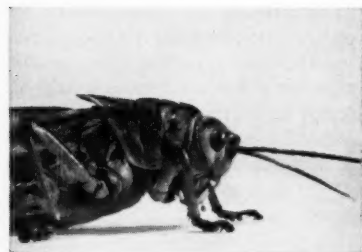
mystified by my lack of satisfactory results. Besides, I enjoyed the evening's photography, although the outcome was disappointing.

Insect photography is not easy. It demands good equipment, skill, patience, and a willingness to learn—to learn by making mistakes, if necessary. The closer one gets to his subject, the more exacting and painstaking must be his work with it. Taking a picture of "all outdoors" is much easier than taking a picture of a single ant, beetle, fly, or other small subject.

The insect photographer had two possible choices to make when it comes to seeking subjects. Outdoors, he can stalk them with his camera and take their pictures where he finds them. Or he may collect them and bring them indoors, to be photographed under more closely controlled circumstances.

#### Stalking the subject

Let us consider the stalking technique first. This takes patience, agility, and luck. Caterpillars and some of the slower-moving insects will "stay put" long enough for the photographer to do a fair amount of focusing and fussing. The faster-moving ones, however, like butterflies, bees, moths and dragonflies, seldom wait until the photographer has focused, adjusted lens aperture, and done the other tinkering that goes into the process of picture taking. He must shoot fast, or the subjects are gone. Since flowers attract butterflies and bees, and since dragonflies seem to have favorite perches, they can be "ambushed" in favored locations. In this way the photog-



Grasshoppers are one of the author's favorite subjects—close-up or otherwise.

rapher can let them come to him, since he can never hope to keep up with them as they flit about.

The most successful way to take a close-up picture of an uncontrolled (unconfined) insect is to have all your adjustments made ahead of

time. The wire framing attachments—either home-made or store-bought—that hold the camera at the proper distance and outline the exact field covered are the most satisfactory aides to this kind of picture taking. It takes experimentation to arrive at the most satisfactory settings but, once determined, these need never be changed.

Picture taking under controlled conditions offers some advantages, perhaps. But my pictures of the mantis were controlled, and I have already pointed out the difficulties there.

Insect photography is particularly rewarding to those who have the



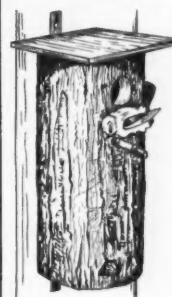
Because of their uniform dark brown color and the high gloss on their armor, rhinoceros beetles present a challenge to the photographer.

interest and the patience to follow a subject through its various life phases, from egg to adult. The interested photographer can collect eggs or larvae, find pupa cases or cocoons, and keep them until the adult insects emerge. He can photograph them from time to time, recording on film the changes in the insect's life. This requires a specially constructed container with a protecting glass cover, so that the insect may develop without being injured. Walking-sticks are good models. For one thing, they are large enough so that photographing them does not require microscopic techniques. Grasshoppers are one of my favorites. Dragonflies I have pursued endlessly, but my best luck with them has come not on the wing, but after I have first caught them in a net. But then the charm is gone—it is the freedom of the dragonfly, the cocky way it turns its head, the verve with which it flits from one twig end to another, that charms me.

#### Skeptical entomologist

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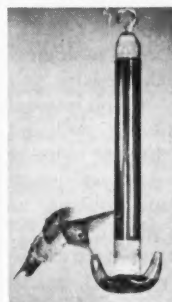
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mature, it is hard to convince anyone that your picture is not of a mounted specimen. I once heard the chief entomologist of a large museum quoted as refusing to believe that any butterfly picture was not an artificially posed one. He was, I think, unduly skeptical. Occasionally, someone does get a good butterfly shot, but such happy events do not occur very often.

One of the most challenging, and at the same time the most exasperating insect models I know of is the big rhinoceros beetle (some people call them June bugs) that I find in the yard every summer. They make me think of heavily-armed tanks—their armor plate is magnificent. The females are impressive enough, with their two stubby side horns, plus a longer horn in the center of the forehead. But the male of the species is truly magnificent. With his three long, sharp horns, he looks like a miniature monster out of a medieval terror tale.

These beetles are a rich dark brown all over. Their wing covers and the armor on their heads and legs all have a high gloss. The under sides of their bodies are duller and covered with short stiff hair. But there are no contrasting color areas, and the glossy surfaces show so many highlights that it is hard to distinguish details.

By the time I find them, in daylight, the beetles have lost their youthful vigor. They move stiffly and jerkily, a little at a time, and that little unexpectedly. I have posed them and focused on them, and they have remained motionless. Then, when I am finally ready to take their pictures, they have suddenly jerked around, or flopped over, so that I must set them back in place and begin my calculations all over again.

Spiders are not insects, zoologically speaking, but much the same techniques can be used to photograph them. Find one on her web and, unless you disturb her by touching that web, you have a good steady model. Your main problems are usually those of getting enough light on the subject (webs are usually in rather shadowy areas) and of blocking out distracting details in the background.

So, thinking back to what I said at the beginning of this article—I guess I do know quite a bit about taking insect photographs. The problem is to juggle all the elements

—subject, setting, equipment, lighting, know-how—into the best possible combination in order to obtain the most satisfactory results. The final ingredient is what? Luck, skill or—to coin a word—insectivity? ♪ ♪ ♪

## Migrant

(Continued from page 244)

every passing second, I tip-toed through the next band of timber and eased up behind some little spruces, to look out on the adjoining meadow. Just as I leaned forward to part the screening limbs in front of me, a terrible roar and clatter erupted right under my nose, and a big cock blue grouse sailed out over the sunny slope. I stood rooted in my tracks for a few moments, and I could distinctly feel the hair on the back of my neck flattening out. Then I moved out of there fast, back the way I had come, and my interest in grizzly pictures went into complete eclipse.

Besides their rather disconcerting habit of getting up unexpectedly with a roar and rush at close range, the Richardson's grouse is an interesting and often entertaining bird. Its numbers have not decreased to a noticeable extent through encroachment by man, for the bird's choice of habitat is amongst the roughest in the world. This is a good thing, too, because to those of us familiar with the wild country that still exists in the west, the mountains and blue grouse go together to form part of the beautiful picture of life in the Rockies. ♪ ♪ ♪

## Getting Acquainted

(Continued from page 248)

wistfully.

Our prize "customer" is an ermine, a male weasel of the species *erminea*. He is one of a pair that we attracted originally by leaving meat on the doorstep at night. When hunger brought him out in the daytime we threw meat to him, and finally I offered it personally, putting it on my boot toes as a precaution against the mammal's reputation for biting. After I had been sitting for many hours on many sub-zero days, the ermine decided that I was harmless and that meat could be taken from my gloved hand with impunity.

When the ermine returned the second winter I forgot about the pre-

caution of wearing a glove, and learned that he took his meat from my fingers with care and daintiness. When I offered my empty hand, he took one of my fingers in his teeth and pulled. When nothing happened, he took a better grip and tried again. I knew that a third grip was likely to be painful, so I pulled my hand away and held some suet out to him. He took this and trotted lightly away over the snow to his storage place under a stump. My finger was just an odd-looking piece of suet to him, something to be detached and taken home if possible!

To attract our attention, the ermine has learned to stand on the shelf by the door and scratch on the removable screen panels that are left in place during the winter to catch blowing snow. If this does not bring us, he scurries up and down the screen until we hear him and appear with his rations.

The ermine has repaid us by controlling the mice that can be a cabin nuisance. We hope that our convenient source of food may help him to a long life, as it enables him to stay at home with plenty to eat when his arch-enemies, the barred owl and the fisher, are abroad in the night.

We feel that we have in no way endangered these wild "people" by letting them come to know us as a source of food. We never attempt to touch them, and we do not entice them into the cabin. They retain their sense of caution. All of them are ready for flight at the least hint of danger, and a sudden movement on our part will send them off in a flash. If any of them should approach other humans who do not feel toward them as we do, I believe that they would readily escape any attempt to touch them, and that they would be as safe as if they had never come in contact with us. ♪ ♪ ♪

## Bulletin

"Natural Science Publications" of the Cranbrook Institute of Science, Bloomfield Hills, Michigan, is a folder of bulletins and books currently available from the Institute. While some listed items are of world-wide interest and scope, emphasis is given to those dealing with the natural history of the Great Lakes region; all are sold without profit to either author or publisher through the Institute.



# Nature IN ROCK AND MINERAL

By PAUL MASON TILDEN

## Where Sea Meets Land

BEFORE YOU READ THIS ARTICLE, glance, if you will, at the photograph

below, in which you will see a tiny segment of rather inhospitable-looking coastline of one of the New England States. This is a point of rock that seems, indeed, to be totally devoid of activity, save, perhaps, for the gentle lapping and sloshing of low tide water among weedy pools. All seems quiet; and yet this photograph is a portrait of violence, both past and present. It represents even today one of the busiest parts of the earth's surface, geologically speaking; it is a scene of constant warfare and endless change, day and night, summer and winter.

Activity for this little strip of land started several hundreds of millions of years ago, when the sediments of the rock in the foreground were laid down. Those sediments are now a hard, rough, rather sandy-looking schist in an advanced state of metamorphism; that is, many of the original mineral constituents have been altered by heat and great pressure into new suites of minerals. As may be noticed in the picture, the

bedding planes of the rock in the foreground stand nearly vertical—an indication of past geological violence.

Some time later, a fresh round of activity commenced. The schist was invaded by two different kinds of "foreigners." The first of these was a coarse granite of somewhat unusual appearance, with blue-gray, flinty-looking quartz, white feldspar, and an unusually small amount of mica. Here and there a blotch of black tourmaline may be found, and little strings of tiny red garnets lend a touch of color to an otherwise rather drab rock that shows as the light streaks in the left foreground, and in the white ribbon of the "sitting" rock fragment.

Later still, countless dikes of basalt—one of which is clearly shown as a near-vertical dark ribbon cutting through the rocks—were squeezed into the schist along its bedding planes. We know that this was the second intrusion, because the dark basalt cuts through both schist and granite. (Shown, also, is another interesting fact. We know that the temperature of the basalt could not have been very high when it was forced into the schist, since

its line of contact with the latter shows no trace of baking or chemical alteration.)

Today, intense geological activity of another kind goes on at this point of rocks. Each flowing of the tide brings a fresh assault on the shore, and the waves that break on it have a number of land-destroying agents at their command.

First, they have the necessary power with which to work. Storm waves look powerful, and they are. On the coast of Scotland during the past century, a breakwater block of concrete, stone and iron weighing 2600 tons was carried away by the waves! Then, too, the waves are charged with abrasives from nearby beaches—highly efficient abrasives like quartz, garnet and magnetite particles (the first two of which go into the manufacture of sandpaper). And cobblestones flung against a rocky shore make potent weapons of destruction, chipping and grinding away at larger rock masses, fracturing and pulverizing the smaller.

You must add to these destructive agents another and invisible force for change. It is solution. Perhaps you have noticed in the photograph that the dark basalt dike seems to be

(Continued on page 276)

This bit of rocky New England shoreline seems devoid of all activity, but to the geologist it presents a story of endless change, conflict and destruction.



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## Rock and Mineral

(Continued from page 275)

disappearing faster than the schist, and tends to leave a vacant channel in it. This is partly because the basalt dissolves faster in sea water than the schist or the granite. Its constituent minerals are less resistant to chemical attack and removal.

Yes, even the most abandoned-looking shore is a place of great activity and great change. You need never feel that, because there happen to be no bathers on the beach or no fishermen on the rocks, there is "nothing doing" at the shore. There is *always* activity where the sea meets the land!

### BOOK REVIEW

#### The Rock Hunter's Field Manual

By D. K. Fritzen. New York. 1959. Harper and Brothers. 210 pages. With a foreword by Wesley Dexter Gordon. \$3.50.

Writers of field guides to the identification of Nature objects like birds or trees have at least one great advantage; a robin looks like a robin, whether it is in Florida or Illinois. An elm tree looks the same in Virginia as it looks in Maine. There is a certain uniformity of appearance in species.

The folk who produce our field guides to minerals have no such luck. They are starting with the premise that specimens as found in the field may only slightly resemble—or resemble not at all, in either color or other characteristics readily recognized by amateur collectors—their field guide counterparts. D. K. Fritzen, in his *The Rock Hunter's Field Manual* can, of course, deal with this problem no more handily than could James Dana when the latter brought forth the first edition of his famous *Manual of Mineralogy* back in 1848. Mr. Fritzen's *Field Guide* presents a well chosen selection of minerals with ample description, and a section on their uses. The book is of convenient size—important in the field—and its entries are arranged in a manner that makes for easy reference.

### Bulletins

"Highlights, National Conference on Air Pollution, 1958" is U. S. Public Health Service publication 648, a profusely illustrated report of

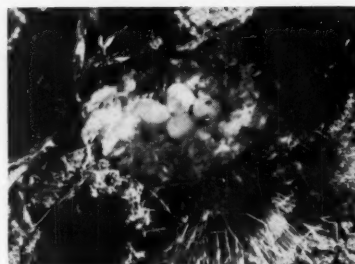
the reasons for, and the results of, the National Conference on Air Pollution held last November in Washington, D. C. This includes the highlights of recommendations made by the Conference concerning a problem that is daily becoming more acute in the United States. It is available from the Superintendent of Documents, Washington 25, D. C., and is priced at thirty-five cents.

"Tree Planters' Notes," issue No. 34, is a publication of the U. S. Forest Service, Washington 25, D. C., and consists of two reports of interest to nurserymen and planters of forest and shelter-belt trees. The first report details forest and wind-barrier tree planting in the United States during fiscal year 1958, and the second is a compilation of forest tree nurseries in the nation for the same year, arranged according to location and ownership, name of resident nurseryman, and production for the fiscal year of 1958.

"Conservation Education at the Grass Roots. . . How Can We Do It Better?" is a twenty-one page report, in pamphlet form, of the 1958 annual conference of the Conservation Education Association. Of special interest to teachers, school administrators, teaching aid producers and club members, this little publication, focusing attention on problems of actual application of conservation education, may be secured in single copies free of charge from Dr. W. F. Clark, CEA Secretary-treasurer, Eastern Montana College, Billings, Montana.

### Calling Young Fishermen

Boys and girls of age nineteen or less who are fresh-water fishing enthusiasts may turn that enthusiasm to good advantage through membership in the Junior Council of Fresh Water Fishermen, of which Mr. Myron Shoemaker, of Laceyville, Pennsylvania, is an associate. The Council is an organization dedicated to the youthful fishermen of America, to help develop them for leadership in both conservation and business careers through their interest in fish and fishing, and cooperates with the Boy Scouts of America, schools, and other organizations involving young people's interest in field and stream. Full information about the aims and requirements of the Junior Council will be furnished on request to Mr. Shoemaker at the address noted above.



NATIONAL PARK SERVICE

This is the first nest of the nene, or Hawaiian goose, reported in Hawaii National Park. The nest and its eggs were discovered by David Woodside, wildlife biologist of the Territorial Board of Fish and Game, at an elevation of 6500 feet in the park.

### Nene Nest

Dr. George C. Ruhle, acting superintendent of Hawaii National Park, has announced that the first nest and eggs of the néné, or Hawaiian goose, to be found in this national park was discovered November 22, 1958, by David Woodside, wildlife biologist of the Territorial Board of Fish and Game. Within two days of the discovery, made at an elevation of 6500 feet in a dense clump of ohelo, five eggs had been laid. The eggs were incubated by the mother néné until December 23, when they were destroyed by some mammal, probably a mongoose. Mr. Woodside commented that the pair of birds probably would renest nearby during the current season. The néné, whose range is confined almost entirely to the west coast of the Island of Hawaii, has been near the verge of extinction, there having been only 30 birds reported alive in 1951. At present, however, there are several projects under way to save the species.

### Spectroscope Kit

Science Materials Center, a division of the Library of Science, 59 Fourth Avenue, New York 3, N. Y., has announced the availability for the first time of an inexpensive, tested and approved hand diffraction-grating spectroscope that can be used for experiments with color at all school grade levels. Different spectra are seen by pointing the instrument at different kinds of light sources, and by using colored plastic sheets and cards included with the kit, the spectrum reveals which colors are transmitted and which are absorbed. The kit and a 16-page experiment book is available from the Science Materials Center at the above address for \$2.00, postage paid.

# THE Nature MARKET

Classified advertising rate — 25 cents a word each insertion; minimum \$5.00, cash with order. Abbreviations, initials, and numbers count as words. Discount, 3 times, 5%; 6 times, 10%; 10 times, 15%. Aug.-Sept. issue closes July 1st. Mailing date Aug. 1st.

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# Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

## Reflection & Refraction

WE HAVE FREQUENTLY WRITTEN IN THESE columns of the behavior of light rays while passing through prisms and lenses. This month we have some interesting photographs to describe, showing certain of these effects. In Figure 1 a right-angled prism, such as forms the basis for design of the Porro prisms used in field binoculars and in binocular microscopes, is shown with parallel light rays coming from the left side and entering the glass surface at a normal (perpendicular). In such a case, the velocity of the rays is slowed in the ratio of 1 (refractive index of light in air) to 1.52 (average refractive index of light in crown glass). The velocity of light is slowed upon entering a denser medium, as from air to glass, and again accelerates on leaving the glass for air. Inasmuch as these rays strike the glass surface at a normal, they are not bent (deviated, refracted); only when the incident (entering) pencils of light strike the glass surface at an angle other than  $90^\circ$  does deviation occur.

When these light rays traverse the glass prism and arrive at the rear surface, a most remarkable effect takes place. The  $45^\circ$  angle of the rear surface is larger than the critical angle for this case; a smaller angle would be necessary for the rays to emerge from the glass surface and be

refracted into the adjacent air. Accordingly, they undergo *total internal reflection*, all of the light being reflected toward the third surface, and passing out of the prism at a normal, without deviation. This phenomenon was described and explained in these columns in the April, 1955, issue of *Nature Magazine*, and it will be appropriate here to repeat a simple experiment that illustrates total internal reflection in a striking manner.

### The experiment

Hold a glass full of water at about half arm's length in front and somewhat above the level of your head. Look at the water's surface from the under side, and note that it resembles quicksilver and is a perfect mirror. Hold the other hand at full arm's length, fingers spread slightly, positioned vertically, beyond and behind the glass, at about the same level. You can now see your fingers twice, once by refracted vision through the lower part of the glass and water, and again by total internal reflection from the under surface of the water.

Now revolve this magazine a quarter turn counterclockwise so that you will be facing in the direction of the incident rays of light as they proceed toward the first face of the prism. Again revolve a quarter turn counterclockwise, facing the bottom of this page, in the direction taken by the emergent or reflected

rays. In so doing, note that the right hand incident ray becomes the left hand emergent ray. This illustrates how it comes about that such a prism reverses and inverts an image, one of its most useful properties in such optical instruments as prism binoculars or stereoscopic microscopes. A second prism, in the light train of the instrument, again inverts and reverses the image, with the result that the final image is erect and unreversed. The prism system of binoculars was discussed and illustrated in this Department for January, 1958.

Figure 2 shows a plano-convex lens, a frequent component of microscope objectives and eyepieces, with parallel light rays entering the plane surface at a normal. At the curved surface the central or axial ray emerges at a normal to that surface, and hence undergoes no deviation, but the two marginal rays, one above and one below the axial ray, emerge at an angle other than a normal and are accordingly *refracted* (bent, deviated). The law of refraction states that at any angle other than a normal, a light ray will be bent *toward* the normal in passing from a less dense into a denser medium, as from air into glass, and *away* from the normal in passing from a denser into a less dense medium, as from glass into air. This is an effect of the difference in the velocities of light in the two media, and the amount of bending depends on the angle of incidence or emergence, and hence on the degree of curvature of the lens, and on its composition, which determines its density.

The result is that the upper mar-

Figure 1.

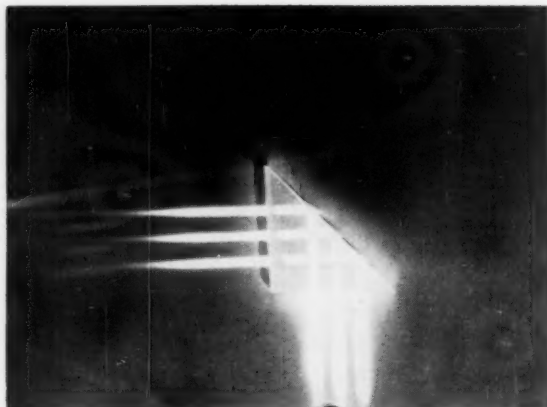
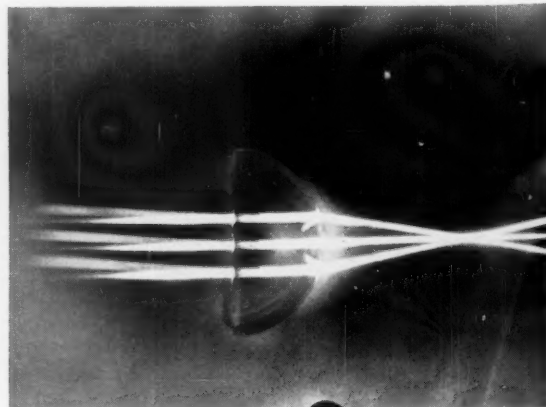


Figure 2.





ginal ray is bent downward and the lower ray upward. They converge and meet at point beyond the convex surface that is the *focal point* of this lens. Other factors being equal, a small, sharply curved lens has a focus close to its surface, and yields high power; a larger lens with slight curvature has a focus farther away, and gives lower magnification. After the rays cross at the focus they continue on to diverge and can form a real image of an object, as is the case with the microscope objective. Because of this crossing through the focus, the image will be inverted and reversed. Note that some of the incident light is reflected backward from the first surface of this lens, showing as faint pencils more or less parallel to the entering rays. This causes loss of some of the light and produces flare in the image, effects that are prevented by coating the lens surface with a molecular layer of a metallic salt. Instruments so treated are said to have coated optics. The lens in this example is a converging, or positive one.

In Figure 3, a biconcave lens is shown, an example of a diverging or negative lens. The parallel entering pencils of light, from the left side, are diverged upon passing through this lens and can never meet to form a real focal point or a real image. Because of reflection backward from the curved front surface, we can see a good model of how a virtual focus is formed. The observer's eye, on the right side of the lens, perceives the diverging rays and mentally projects them backward to a focus, a feat the rays themselves never perform. Such a focal point and an image made thereby have no real

existence and are therefore termed virtual. The eyelens of a compound microscope, although not a biconcave lens, works in a similar manner to present a virtual image.

Figure 4 combines a biconcave and a biconvex lens. Entering rays are diverged by the biconcave lens and then converged by the second one. The biconvex lens overcomes the divergence of the first lens and is strong enough to confer a residual convergence as a total effect, with the focal point this time much farther away and out of the picture. This illustration gives an idea of how light rays may be deviated, first one way and then another, in passing through a series of lenses, and also shows the serious amount of flare created by reflections from uncoated optics.

## Book Reviews

WE SHALL interrupt our current series of reviews of modern texts of zoology to discuss two very recent works on general biology. A chief reason is to introduce the older biology and then the new zoology by the Milnes, a married team that is rapidly making a national reputation as authors, photographers and screen tour conductors.

No greater contrast could be found than in the following books, and the reader or prospective adopter should review both of them carefully to appreciate the tremendous divergence that is possible in presentation of essentially the same material. Some will prefer one type, some the other, and that is as it should be. As the sage remarked: "It's a good thing that we don't all love the same woman."

*Principles of Biology*, by Whaley, Breland, Heimsch, Phelps, and Schrank, with contributions by Oliver, Spear, Wheeler, and Wyss, University of Texas, 2d ed., Harper & Bros., 49 E. 33d St., New York 16, 1958. Pp. x, 877, figs. 460. \$6.75.

This is a fine book, well printed, with a very thorough coverage of the whole field of biology, well illustrated with many original drawings, chiefly the work of the medical illustrator, Thomas C. Brooks. Predominantly a principles book and, accordingly, scant attention to some of the animal groups (e.g., Echinoderms). Botanical portions more complete than the zoological. In our opinion, too much emphasis on organic chemistry, much of it beyond the comprehension and certainly beyond the interest of the average non-biology major.

The plan is good. First, introduction to biology, organization, protoplasm; then cells and tissues, diffusion, plant parts, chemical correlation in plants, then animals, then animal functions. Microorganisms follow, with mitosis, meiosis, heredity, development, and then the systematic coverage of both kingdoms. Lastly, ecology, pathology, evolution, and history.

The writing is heavily factual, dry, with no trace of humor, anecdote, or sufficient illustrative examples from everyday experience. The book is a compilation of facts, with no stimulation to explore the subject. The lack of an interest-getting style and of an integrating principle such as evolution are handicaps that are probably due to the multiplicity of authors.

*The Biotic World and Man*, by Lorus

Figure 3.

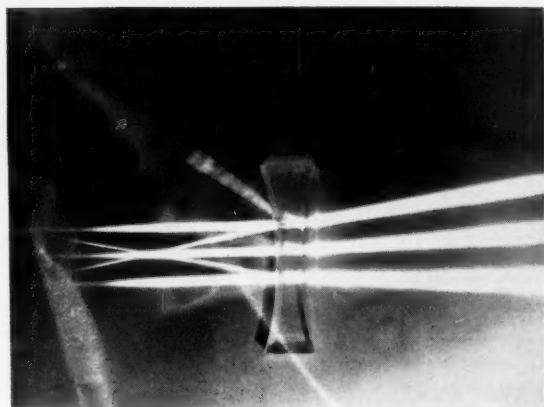
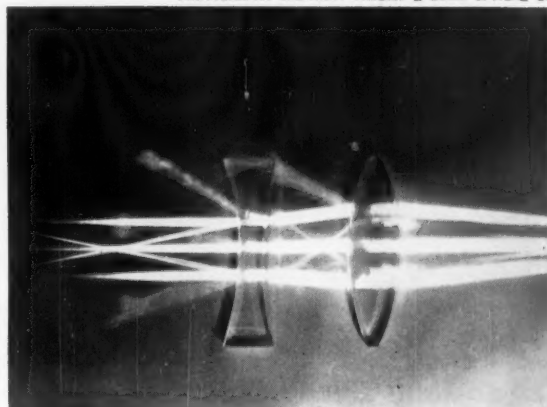


Figure 4.



PHOTOGRAPHS COURTESY BAUSCH & LOMB OPTICAL CO.

J. Milne and Margery J. Milne, University of New Hampshire, 2d ed., Prentice-Hall, Inc., Englewood Cliffs, N. J., 1958. Pp. xiii, 530, 20 end-paper photos, figs. 244, photos 467, \$7.95.

Like some of the recent texts of general zoology that we have been reviewing, this book is a far cry from the general biology texts of a decade

ago. It is different in format, content, and philosophy—as different as night from day. A book like this must be seen and reviewed carefully to appreciate the recent advances in the arts of writing, illustrating, and printing a textbook designed to stimulate the average college freshman.

To begin with, it is a far more

beautiful book than has been customary, much more attractive to the student. It is in the modern two-column-per-page format, the type is exceptionally readable (a most important point, sometimes overlooked), and the 487 photographs are new and most compelling.

In content, the authors stress material that will be of service to the general student and general reader, and avoid a striving for full technical detail—a presentation of every possible fact, as is so often, alas, true of the "shotgun" type of text. Their selection of what is and what is not to be included is admirable. The approach is philosophical and naturalistic and heavily economic and conservationist, the authorship is authoritative, the style of writing is upgraded and compels alert and comprehending mentality on the part of the reader.

We detected a number of typographical errors (wrong references to figure numbers; "Jennings" discovered smallpox vaccination) and we feel that the authors dodged the real issue of ultimate human conservation, a strong, all-out argument on birth control.

For those who wish a text that will compel thought, that will build character for the non-professional, and that will entertain while instructing, this is one of the finest recent publications. The professional biologist will find here an amazing number of facts he never heard of before. This is a "life" approach to biology that asks, and aids in answering, the questions of the nature of man, whence he came, and whither he is going, at the same time not neglecting the basic material on both the plant and animal kingdoms.

## Correspondence Requested

**A**N AMATEUR microscopist who states that he is an avid reader of these columns wishes to correspond with others whose interests are similar. He is H. Scott Rees, 15126 Lanning, Lakewood 7, Ohio. He recommends the following method for clearing objects without recourse to absolute alcohol: dehydrate to 95 percent alcohol, then place in carbol-xylol for 10-15 minutes, next in clove oil or cedar oil for 5-10 minutes, and finally rinse in xylol before adding the mountant.

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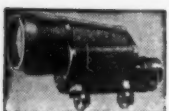
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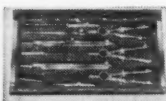
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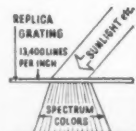
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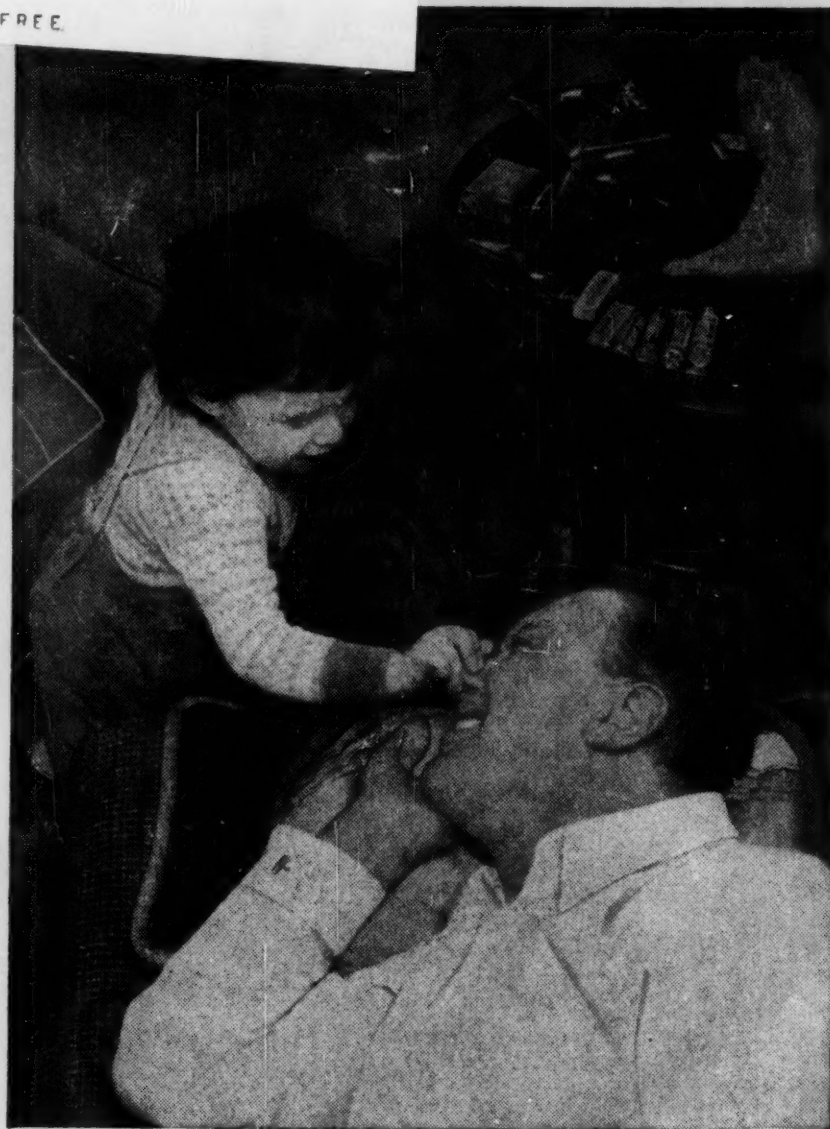
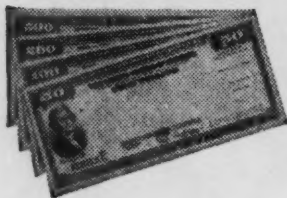
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